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Soil Survey
of
Falls County, Texas

By
M. W. BECK

Bureau of Chemistry and Soils
In cooperation with the
Texas Agricultural Experiment Station

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SOIL SURVEY OF FALLS COUNTY, TEXAS[1]

By M. W. BECK

COUNTY SURVEYED

Falls County is in east-central Texas (fig. 1). It lies mainly within the blackland prairie region, although the extreme southeastern part includes a small segment of the western fringe of the east Texas timber country. Marlin, the county seat, is about 100 miles south of Dallas and about 200 miles northwest of the Gulf of Mexico. The county is rectangular in shape and includes an area of 757 square miles, or 484,480 acres.

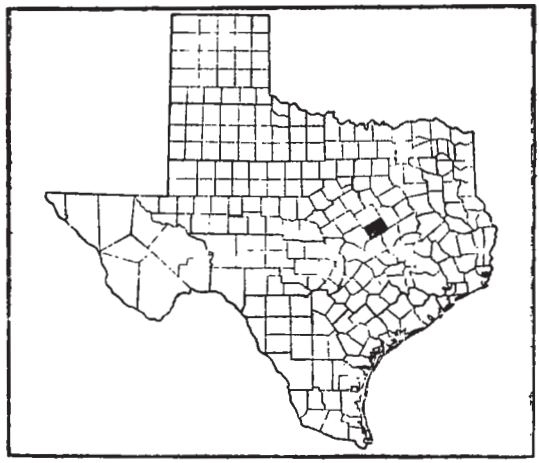

FIGURE 1.—Sketch map showing location of Falls County, Tex.

The surface relief in general ranges from undulating to rolling, and there are some large bodies of flatlands and many shallow valleys along the numerous large and small streams which pass through or originate within the county. The largest stream, Brazos River, passes through the center and has a shallow valley 2 or 3 miles wide, bordered by low moderately sloping upland escarpments which, in many places, mark the boundaries between the flood plains and the flat ancient stream terraces lying high above overflow. The terraces gradually merge with the still higher uplands. The flood plains of some of the larger creeks range from one-fourth to 1 mile in width. The largest creeks are Little Brazos River and Big Creek. The prairie lands, although now mostly in cultivation, originally supported a heavy growth of bluestem, sedge grasses, smaller bunch grasses, and in places a few mesquite trees. The east Texas timber country section still retains a rather large number of the native oak trees. The bottom lands, originally heavily timbered with elm, oak, ash, hackberry, pecan, and other trees, retain this growth only in such places as those where the land is too frequently overflowed to allow satisfactory cultivation.

[1] Report written by W. T. Carter.

19323—36——1

The elevation of the county ranges from about 300 to 500 feet above sea level, and extreme elevations of about 700 feet are in the southwest corner. The general slope is to the southeast.

Blue Ridge, a local elevation extending from near Reagan northward nearly to the Limestone County line, is about 550 feet above sea level. In places the western side of this ridge rises rather steeply to a height of 75 or 100 feet above the adjacent land, but on the east side the slope is very gradual. West of Brazos River in the blackland prairie the larger streams are southeastwardly flowing creeks which occupy valleys bounded on the south and west by well-defined moderately steep escarpments, but on the east side of the river the land is lower and less steep.

The county is well drained, and numerous streams, all belonging to the Brazos River drainage system, reach all sections of the upland and remove run-off rain water rapidly. The bottom lands are frequently inundated, but this does not prevent successful cultivation of farm crops in many places. Erosion occurs on many of the steeper slopes and has been especially injurious in removing topsoil from such areas that are devoted to cultivated crops.

Good water is obtained from wells on most of the farms in the timbered sandy lands, in stream bottoms, and on the high flat stream terraces underlain by sand and gravel. On the dark prairie lands, however, only moderate quantities of water are obtained in shallow wells. Here many small earthen reservoirs are built to catch and hold rain water for the use of livestock.

Falls County was organized in 1850 from parts of Milam and Limestone Counties. The first settlement in the country now included in Falls County was at Viesca in 1834, in the southern part, but this has been abandoned.

The timbered sections near the streams were the first to be settled, because of their accessibility to wood and water. Some local reports have been made of Indian farms located on the sand soils of the Brazos River bottoms. The first white settlers came from other parts of Texas and from the older Southern States. The present population of about 38,000 consists largely of the early settlers and their descendants. The population numbered only about 16,000 in 1880. In various parts of the county there are thickly settled communities of people of German, Austrian, and Italian extraction, and a rather large number of Negroes are distributed in the timbered areas and the bottom lands. All parts of the county are well settled, but the densest population is on farms in the prairie lands.

Marlin, the county seat and principal town, has a population of more than 5,000. Besides being an important trading and shipping center, it has mineral artesian waters and sanitariums which attract many thousands of health-seeking persons annually. Other locally important small towns are Rosebud, Chilton, Lott, Travis, Reagan, and Perry.

Lines of the Missouri Pacific Railroad, Southern Pacific Railroad, and Missouri, Kansas & Texas Railway pass through the county and afford good transportation facilities to many of the larger marketing centers and Gulf shipping ports.

Most of the roads are well improved but unsurfaced graded earth roads. The principal highways are paved or gravel-surfaced. The

unsurfaced roads become almost or quite impassable during long periods of wet weather.

The county is well served with rural schools and churches. Large consolidated schools are located in places, and many children are transported by bus to the large town and country schools. Rural mail delivery reaches most sections, and many farm homes are served by telephone. Automobiles and radios are in common use, and in many sections electric service and natural gas are available. Cotton gins are located at convenient points, and a cotton compress and cottonseed-oil mill are in Marlin.

CLIMATE

Falls County has a temperate and healthful climate characterized by long summers with prevailingly high temperatures. These are tempered, however, by southern breezes which blow most of the time. The winters are short with periodic cold waves lasting a few days, which are accompanied occasionally by short periods of below-freezing temperatures. Some winters pass with very little freezing weather, and in some winters severe sudden north winds called "northers" are accompanied by freezing weather during January and February. Light snows fall during some winters, whereas other winters pass with no snow whatever.

The climatic data given in table 1 are taken from the records of the Weather Bureau station at Temple, Bell County, about 30 miles southwest of central Falls County. They closely represent conditions in Falls County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Temple, Bell County, Tex.*

[Elevation, 687 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1902)
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*
December	48.5	90	9	3.00	0.05	3.22
January	47.4	85	4	1.95	1.16	.30
February	50.1	94	−4	2.11	.77	.99
Winter	48.7	94	−4	7.06	1.98	4.51
March	58.8	100	19	2.52	.37	2.37
April	66.6	100	29	4.25	2.74	2.89
May	73.5	102	39	4.42	2.89	5.67
Spring	66.3	102	19	11.19	6.00	10.93
June	81.0	111	49	3.00	2.35	1.91
July	84.1	110	56	2.02	2.06	20.42
August	84.0	110	50	2.04	.85	.00
Summer	83.0	111	49	7.06	5.26	22.33
September	78.5	103	43	2.81	1.86	5.03
October	68.0	100	26	2.97	(1)	2.48
November	57.4	94	19	2.87	1.94	13.90
Fall	68.0	103	19	8.65	3.80	21.41
Year	66.5	111	−4	33.96	17.04	59.18

[1] Trace.

The average date of the last killing frost is March 9, and of the first is November 20, giving an average frost-free season of 256 days. The latest killing frost recorded was on April 15 and the earliest on October 29.

Falls County, although well within the humid section, lies far enough west to feel at times the effects of uncertain and insufficient rainfall, but as a rule the annual precipitation is ample and well distributed throughout the growing season. Corn especially is subject to injury during short periods of summer drought in the critical stage of its growth, and cotton and other crops also suffer in some seasons from lack of adequate moisture.

AGRICULTURE

The early settlers of Falls County established homes in the sandy timberlands and near the streams, and they first grew such food crops as corn and vegetables in small fields. Long before any attempts at farming were made, however, the open prairie range was utilized by ranchers in raising cattle and horses. The heavy dark prairie soils were covered with a dense growth of nutritious grasses, largely the bluestems and some grama, and in places the short grass, or buffalo grass, which locally is known as curly mesquite grass. With larger fields placed in cultivation, some cotton was successfully produced at an early period on the soils of the alluvial bottom lands, and when wire fencing became possible early in the eighties, this crop, together with corn and oats, was extended onto the prairie soils. Because of the practice of general farming on these rich virgin prairie soils, the land was quickly fenced and a very large proportion soon placed in cultivation. Much of the early development of cotton farming was on the rich soils of the river bottoms. Some land was farmed with Negro slaves before the Civil War.

At the time of the last census (1930) 89.5 percent of the land in this county was in farms, and the average size of farms was 70.9 acres. Of the 6,014 farms, more than 4,000 range from 20 to 100 acres in size, and nearly 1,000 from 100 to 174 acres. About 68.5 percent of the land is devoted to farm crops, with a somewhat higher proportion on the dark prairie soils than on the timbered soils.

The agriculture has always been more especially concerned with the production of cotton as a cash crop and the growing of feed crops, mainly corn, oats, and the sorghums to provide for the local and home requirements of the farm livestock. This has provided a system of commercial farming combined with a certain amount of subsistence-crop production for home use in small gardens and orchards on most farms, but on many of the dark-soil prairie lands, food crops have not been produced in sufficient quantities to sustain the rural population, and much of the necessary foods have been purchased from places outside. Small areas have been sown in wheat at various times, but very little wheat is now grown, although moderate yields can be obtained on some of the dark-colored heavy upland soils.

The yield of cotton has at times suffered considerable reduction, owing to insect pests—largely the bollweevil—on the sandy timbered upland soils and more especially on the alluvial soils, and by the ravages and losses of the crop on the dark upland soils because of

the cotton root rot disease. Losses from insects are now generally less than formerly, but injury to the crop from root rot continues to be rather severe, especially in seasons when much rain falls in spring and early summer.

Cotton is grown on 73.8 percent of the crop land, and corn on 15.2 percent, the remaining 11 percent being largely in oats, sorghums, hay crops, and miscellaneous truck and orchard crops produced largely around the farm homes for home use. The local markets do not require great quantities of vegetables, truck crops, fruits, and berries. The necessary supply is furnished to some extent by surpluses produced around the farm homes, although a small amount of truck farming and orchard growing is carried on, the principal products being potatoes, sweetpotatoes, and watermelons. Vegetables and truck crops are not generally produced for shipment out of the county, but some tomatoes are grown for market under highly specialized conditions on small acreages of a number of farms. Milk is produced mostly for home and local use, and some farmers produce cream for shipment. Sudan grass, grain sorghums, sorgo, and alfalfa are valuable feed crops produced on many farms. Owing to the special requirements of alfalfa, its production is limited mostly to the alluvial soils where small plantings aggregating several hundred acres are successfully grown.

Table 2, compiled from the United States census reports, shows the acreage devoted to the principal crops, by decades, from 1879 to 1929.

TABLE 2.—*Acreage of principal crops in Falls County, Tex., in stated years*

Year	Cotton	Corn	Oats	Hay	Year	Cotton	Corn	Oats	Hay
	Acres	*Acres*	*Acres*	*Acres*		*Acres*	*Acres*	*Acres*	*Acres*
1879	39,669	29,943	1,200	92	1909	158,969	66,961	4,895	6,617
1889	64,641	30,580	2,765	2,186	1919	188,383	51,613	15,345	9,091
1899	152,398	63,961	7,226	5,304	1929	241,098	49,730	6,271	4,453

From table 2 it will be seen that cotton has always been the chief crop. Although a number of Texas counties produce annually more cotton, this is one of the leading cotton-producing counties of the State. This is because of the large extent of smooth highly productive soils well suited to this crop. Some of the soils on which cotton is grown are not highly productive, but on the whole the average production compares well with that of most other counties of the blackland prairies. The prevailing length of staple is about 1 inch or slightly longer. Mebane, Kasch, Rowden, and Lone Star are the principal varieties grown. The soils best suited for cotton are the alluvial soils, although occasional overflows, local conditions of poor drainage, and excessive injury from insect pests are modifying conditions which are unfavorable and often cause a yield lower than the inherent productiveness of the soil would produce under best conditions. Practically all the dark-colored upland prairie soils are well suited to this crop and produce good average yields. As most of the land in the county belongs to this group, cotton is grown and produced most extensively on these soils. The modifying con-

ditions unfavorable to production here are injury from cotton root rot and, on some slopes, soil erosion which, in some places, is greatly facilitated by growing a clean-tilled crop like cotton which affords little protection against washing by heavy rains.

Corn ranks second to cotton in importance. It is grown for feeding the farm livestock and not for shipping, although some may be sold locally when a surplus is produced. Surcropper and some strains of white and yellow dent are the principal kinds grown. The well-drained alluvial soils are the best suited to the production of corn, owing to the good moisture conditions of the permeable deep soils which have a high water table and also carry a large reserve of soil moisture into seasons which may be too dry for best production of the crop. The dark upland soils of the prairies, especially the flat smooth deep soils, are well suited to corn, but moisture conditions are not quite so suitable as on the bottom lands. The timbered sandy light-colored soils are not well suited to corn unless well provided with organic matter and fertilized, but the smoother areas of some of these provide fairly good moisture conditions.

Oats are grown successfully on the heavier dark prairie soils and the well-drained alluvial soils. Only small quantities are grown, as a rule, mainly for home and local use in feeding the farm livestock. On some shallow dark prairie soils oats seem to be a more profitable crop than cotton or corn, and therefore some of these soils, such as Houston clay, shallow phase, are used mainly for oats, although other soils are better suited to a larger production. The light-colored sandy soils are not well suited to oats and are not used for producing this grain, but on some farms oats are sowed for winter and early spring pasture on such soils. The variety of oats most commonly grown is Red Rustproof.

The hay crop ordinarily occupies about the same acreage as oats. It includes various crops, as Sudan grass, sorgo, and prairie hay, together with some roughage from grain sorghums. These hay crops are produced to some extent on most farms, and the highest yields are obtained on the well-drained alluvial soils and on the dark heavy upland soils. The light-colored sandy soils produce low yields and are better suited to sorgo and Sudan grass than to other hay crops. Alfalfa does best on well-drained alluvial soils, and there are many small fields which are producing satisfactorily.

Grain sorghums, largely hegari, but some kafir, milo, and feterita, are grown by some farmers, and they produce well on all the important soils of the county, the highest yields being obtained on the alluvial soils.

Market gardening is not extensively practiced, but some potatoes, sweetpotatoes, watermelons, and tomatoes are grown in a small way for local and, sometimes, for outside markets. Numerous other vegetables and truck crops, besides peaches, pears, plums, grapes, and berries, are grown in many farm-home gardens, and the surplus above home requirements is marketed locally in the towns. Native pecan trees, many of which have been grafted with improved varieties, and some planted trees grow on some of the alluvial soils where underdrainage is good. The 1930 census reported 8,930 bearing pecan trees in 1929, with a yield of 52,162 pounds of nuts. The light sandy soils are best suited to vegetables, fruits, grapes, berries, and

the various truck crops, and most of these crops are produced on such soils. However, many of these products, both fruits and vegetables, are grown successfully in home gardens on the dark heavy soils in the spring and early summer. The dark heavy soils are better suited to onions, cabbage, garlic, and similar crops than to vine plants.

Cowpeas grow well on most of the soils and, together with black-eyed peas and various field peas, are grown to a large extent on the sandy soils. They produce good yields of seed and hay and also improve the soils.

As a source of income the livestock industry has for a long time been less important than farm crops. Although there are now no large ranches or livestock farms in the county, the various kinds and quantities of livestock products are by no means unimportant. Many farmers raise some cattle and hogs in connection with general farming, and some horses and mules are raised. According to the census, there were on April 1, 1930, 21,090 cattle on the 3,593 farms reporting, most of which were dairy cattle. The dairy cattle are mainly of the Jersey breed, and the beef cattle are Hereford grades. The dairy cattle are kept chiefly for the production of milk and butter used in the home, but some milk is sold locally, and some cream is shipped by a few farmers.

The 1930 census reports 4,434 horses and 15,335 mules on the farms. These animals are of medium size and draft and are used as the farm work animals. The same authority states that there were, on April 1 of that year, 13,355 swine and 225,049 chickens more than 3 months old. Some swine, chickens, and chicken products are shipped out, but the largest proportion of them are used in the farm home or sold locally.

The value of field and orchard crops, vegetables, and farm garden products in 1929 was $8,307,662; domestic animals, chickens, and bees on farms, $2,416,485; dairy products and butter churned, $375,117; poultry raised, $349,829; chicken eggs produced, $410,179; chicken eggs sold, $209,576; and chickens sold, $62,664.

In 1930, tenants operated 77.3 percent of the farms, owners 22.4 percent, and managers 0.3 percent.

The farm lands are usually leased on a share basis, the third-and-fourth system prevailing, whereby the owner furnishes land and buildings and the tenant furnishes the work animals, implements, and expense and labor of producing the crops. The landlord receives as rental one-fourth of the cotton produced and one-third of the grain. Much of the land is leased on the half-and-half basis, whereby the owner furnishes land, work animals, implements, and seed and receives one-half of all crops produced. A very large proportion of the tenants are Negroes and Mexicans.

Farm improvements are for the most part fairly good, and many of the homeowners have substantial dwellings. Most tenants live in small unpainted houses. Farm buildings and fences are as a rule better on the prairies than on the timbered light-colored sandy soils. Farm machinery is of improved types and is adequate. Some farms are operated almost entirely by tractor power.

Some commercial fertilizers have been used with success on the sandy light-colored soils, as evidenced by increased production. The

use of fertilizer has not proved generally satisfactory on the dark-colored upland soils. In 1929, only 203 farms reported the use of fertilizer which was valued at $12,300, or $60.59 a farm reporting. Probably most of this was used on such special truck crops as tomatoes. The soils respond best to fertilizers having a high percentage of nitrogen and phosphoric acid. A fertilizer that has proved satisfactory, according to some of the farmers, is one containing 4-percent nitrogen, 12-percent phosphoric acid, and 4-percent potash.

Many farmers have begun to terrace the sloping fields, in order to diminish erosion which in places has been injurious in that much of the topsoil has been washed away and in places deep gullies have been cut, rendering the land useless for cultivated crops. Large areas of the dark prairie upland soils have been protected by terracing.

Practically no attention is given to a systematic crop rotation, although many farmers change the land and crops from time to time and recognize the value of such a practice. Some dark prairie soils, on which cotton is subject to injury by cotton root rot, have been found to respond well to a rotation of cotton, corn, oats, and other crops, and at the same time, with clean cultivation, much of the cotton root rot injury is avoided. This fact has been demonstrated at the Blackland Experiment Station near Temple in Bell County, adjoining Falls County on the west.

SOILS AND CROPS

Falls County is one of the leading agricultural counties of the State, owing to the large extent of smooth, deep, productive soils which are well suited to the production of the leading general farm crops.

Cotton, the principal cash crop, is the most important crop grown, and corn ranks second. As has been stated, the rest of the crop land is used mainly for oats and various feed crops, in addition to vegetables, truck crops, and fruits for home and local markets.

All the soils are more or less suited to these crops, and, although they differ to some extent in suitability for the various crops, the chief difference, so far as the important cash crops and feed crops are concerned, lies in their degree of productiveness, or quantity produced to the acre. The soils of this county may be readily included in four groups, on the basis of their importance and value in producing the leading crops. Not only on the general basis of productiveness does this broader differentiation stand, but the group relationships are predicated on soil characteristics which have direct bearings not only on suitability to specific crops, productive capacity, and general usefulness, but on similarity in color, structure, and general mode of development. These groupings also fit in with the superficially observable characteristics and features, and therefore may be readily distinguished and recognized. The four groups, in order of their importance to agriculture in this county, are as follows: (1) Dark-colored upland soils, (2) alluvial soils, (3) light-colored sandy upland soils, and (4) miscellaneous soils of low productivity.

The group of dark-colored upland soils is by far the most extensive. These soils occupy the blackland prairie, the important area of dark soils that have been developed from the limy unconsolidated formations of the Upper Cretaceous system and which constitute the most valuable and most intensively utilized large farming area within the State. The dark prairie soils are separated into three subgroups on the basis of differences in texture and structure. They are (1) friable heavy dark-colored upland soils, (2) tight heavy dark-colored upland soils, and (3) dark-colored sandy upland soils. Although they are all highly productive and suited to the principal crops, they differ in degree of productiveness and in methods required for their utilization. They occur in large areas and are closely associated. In places, several square miles consist of but one soil type.

The alluvial soils comprise wide and narrow bottom lands along the streams. The largest bodies are along Brazos River. This group of soils is set apart on account of their very high productivity and not because of their common origin from recently deposited soil materials. These soils are in general smooth, have a high degree of fertility, and are well suited to cotton and corn, the principal crops. They are the most productive soils of the county but, owing to their smaller extent and to some disadvantages of overflows and insufficient drainage, are not so important as the large bodies of dark upland soils. The alluvial soils could be separated into two smaller groups on the basis of differences in natural drainage and protection from overflows, which modifying conditions render some alluvial soils of but little use at present, but, owing to their similarity in natural productivity, they are treated in one group.

The light-colored sandy upland soils are representative of the great area of the sandy timberlands which extend eastward through several States. Only a small part of this region, of which the Texas part is known as the "east Texas timber country," reaches into Falls County and occupies several square miles along the eastern edge. These soils have been developed from the outcropping noncalcareous unconsolidated beds of sand and clay of the Eocene formation. The soils generally are of light color, low in organic matter, and acid in reaction; they have leached very sandy topsoil layers; and most of them have clay subsoils. They are of low or moderate productiveness, although they respond well to approved practices of soil improvement. They have fair adaptation to cotton and corn but are better suited to vegetables, truck crops, fruits, berries, and peanuts.

The miscellaneous soils of low productivity comprise, for the most part, several shallow and eroded thin soils scattered throughout all parts of the county. They are not extensive and in general are farmed only when they comprise parts of fields made up chiefly of more productive soils.

Each of the soil groups includes a number of soil types, but, owing to the rating of the soils in reference to their productive importance, not all the soils of a series may occur in one group.

In the following pages, the soils of Falls County are described in detail, and their agricultural importance is discussed; their distribution is shown on the accompanying soil map; and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Falls County, Tex.*

Type of soil	Acres	Per-cent	Type of soil	Acres	Per-cent
Houston black clay	75,392	15.6	Yahola fine sandy loam	20,864	4.3
Houston black clay, flat phase	8,640	1.8	Trinity clay	15,296	3.2
Houston black clay, gravelly phase	896	.2	Pledger clay	10,688	2.2
Houston clay	35,328	7.3	Catalpa clay	16,960	3.5
Houston clay, colluvial phase	3,840	.8	Catalpa clay loam	9,472	2.0
Bell clay	24,320	5.0	Ochlockonee fine sandy loam	2,752	.6
Lewisville clay	4,480	.9	Milam fine sandy loam	3,840	.8
Crockett clay loam	4,544	.9	Norfolk fine sand	6,336	1.3
Wilson clay loam	48,576	10.0	Susquehanna fine sandy loam	10,880	2.2
Wilson clay	11,328	2.3	Tabor fine sandy loam	1,664	.3
Irving clay loam	9,600	2.0	Leaf fine sandy loam	27,584	5.7
Wilson fine sandy loam	35,008	7.2	Houston clay, shallow phase	768	.2
Irving fine sandy loam	9,280	1.9	Houston clay, gray phase	3,200	.7
Crockett fine sandy loam	13,824	2.8	Chalk (Houston material)	64	.1
Falls fine sandy loam	22,912	4.7	Sumter clay	8,576	1.8
Riesel fine sandy loam	960	.2	Irving clay loam, shallow phase	10,112	2.1
Miller clay	14,272	2.9	River wash	384	.1
Yahola clay	11,840	2.4	Total	484,480	

DARK-COLORED UPLAND SOILS

The dark-colored upland soils occupy the greater part of the farm land, and on them are produced the greater quantities of the farm products. They are dark prairie soils of high natural productivity, and they are very representative of the blackland prairie section of the State. They have been developed from calcareous parent materials, under a grass cover. Most of them are heavy in texture and of good productivity.

FRIABLE HEAVY DARK-COLORED UPLAND SOILS

The friable heavy dark-colored soils of this group are the most extensive and most valuable agricultural soils of the county, and on them are based the major farming activities. They include Houston black clay, together with its flat phase and gravelly phase; Houston clay, with a colluvial phase; Bell clay; Lewisville clay; and Crockett clay loam. These soils occur in large areas and are in general closely associated. Many of the farms include one or more of these soils, which are deep calcareous soils, those of the Houston series being crumbly and granular when dry but very sticky when wet. The topsoils work readily to a friable loamy seedbed when cultivated properly. The Bell soils are very similar to the Houston, but they are superimposed on gravelly or coarser parent material layers which provide comparatively free underdrainage and a storage reservoir for ground water. The Lewisville soils are very similar to the Bell soils, but they are not so dark and contain less organic matter. The Crockett soils are similar to the Houston in surface appearance, but they do not contain so much calcium carbonate, are less friable, and are somewhat less productive.

Houston black clay.—Houston black clay is the most extensive soil of the county, and as it is one of the most extensive soils of the blackland prairies, it practically dominates the agriculture of that great dark-soil region. Probably 90 percent of it is in cultivation.

Houston black clay, to a depth ranging from 12 to 20 inches, consists of black calcareous clay which grades into slightly lighter colored heavy calcareous dark-gray clay. At a depth ranging from 3 to 5 feet, this material grades into yellow or yellowish-brown marl or, in some sections of the western part of the county, into soft chalk or chalky marl. In places the layer of yellow marl is wavelike in sharply extended upward projections reaching to within 12 inches of the surface, the black clay between these subsoil waves being several feet thick.

When wet the black clay topsoil is exceedingly tenacious, giving rise to the commonly used name of "black waxy land." On drying the soil breaks down to fine grains, and when cultivated under proper moisture conditions the surface layer becomes a friable loamy mass. In dry seasons the black topsoil breaks apart, and cracks several inches wide extend downward to the marl. This cracking of the soil takes place for the most part in uncultivated areas, although in extremely dry seasons cracks form, even in cultivated fields. Although the clay surface soil and subsoil are both very heavy in texture and fairly dense, the granular character allows ready access of air, water, and plant roots to all parts of the soil mass, thereby affording good underdrainage and a vast feeding area for the root systems. This feature, together with the high proportion of available plant nutrients, makes this a valuable soil of high productivity, which is readily maintained by observance of simple rules of soil conservation.

The surface relief is undulating or gently rolling, and surface drainage is rapid, although underdrainage is slow. Slow permeability, together with the friable granular character of the topsoil material, favors rapid erosion, especially in clean-cultivated fields, and this has caused injurious washing of the land and, as a consequence, reduced crop production on many of the more steeply sloping areas. Under natural conditions the prairie grasses grew thickly and, owing to this heavy growth of grasses which returned a large residue of vegetable matter to the soil every year, the soil originally contained a large quantity of organic matter. In the virgin condition, the surface was pitted with numerous small inequalities, locally called "hog wallows." These were caused by the cracking of the dry soil and the subsequent washing into the cracks of adjacent soil material.

Because of the deep layers of heavy soil and the underlying beds of marl, a considerable reservoir for the accumulation of soil moisture is provided, and the soil is not droughty but will carry crops for a long period in dry seasons, provided some reserve of water is in the subsoil and parent materials. The deep, free ground-water supply, however, is deficient, and as a rule a good supply of well water is not available in this soil.

Houston black clay is considered the most valuable of the more extensive upland soils, and many farms consist entirely of this one soil type. It is naturally highly productive and produces good yields year after year, where not allowed to erode severely. On smooth very slightly sloping fields that are not subjected to severe erosion, crops are grown year after year with slight if any diminution in production, especially where rotation is practical and the organic-matter content is maintained.

This soil is well suited to many of the general-farm crops, and cotton, the chief crop, which occupies about 73 percent of the crop land, yields from one-fourth to 1 bale an acre, depending on the field and on the season. Average cotton yields for this soil are reported locally by farmers to be about one-half bale or a little higher under normal conditions. Cotton root rot, a fungous plant disease, is especially severe on cotton on this soil, and during some years, especially those having heavy rainfall in early summer, this causes a large loss of the crop on many farms. Corn is grown on about 15 percent of the crop land, and yields range from 20 to 40 bushels to the acre. The soil seems well suited to corn, and usually a good growth of the crop promises a good yield, but frequently a dry period in early summer occurs just at the critical period of growth and reduces the yield very materially. The rest of the crop land is used for various feed crops, and the grain sorghums produce good yields of grain and forage. Some farmers grow oats, yields of which range from 30 to 75 bushels an acre. Small grains, such as wheat and barley, are grown on a few small areas, but as a rule climatic conditions are such that these crops are not highly successful, although possibly certain varieties may in time be developed that will be better suited climatically and allow more production of these and other small grains on this soil in this latitude. In the northern part of the blackland prairie region, climatic conditions favor the production of small grain on this soil, and in some counties a rather large quantity of wheat is grown. Sorgo and Sudan grass are grown for hay and to some extent for grazing. Small quantities of alfalfa have been grown successfully, but the long hot summers, together with the fact that the soil dries and cracks, cause this soil to be less suitable to alfalfa than some of the alluvial soils.

A small acreage of this land is devoted to home gardens and some fruits, and, although this soil is not highly suited to most vegetables and fruits, considerable quantities are produced for home consumption, especially in the spring and early summer. Of the fruits, peaches and plums appear to be the most commonly grown, but many farmers make little attempt to grow fruits. Grapes, berries, and various other small fruits are said to do moderately well when well cared for. Onions have been grown commercially with good success on this soil in some of the more northerly counties of the State and doubtless would do well in this county.

In a few places there are small quantities of subangular rounded chert gravel, ranging from 1 to 2 inches in diameter, in the topmost few inches of soil and scattered over the surface, but this material does not occur in sufficient quantity to cause a difference in production or in methods of cultivation.

Houston black clay, flat phase.—Houston black clay, flat phase, differs but slightly from the typical soil, and in textural and structural characteristics the two soils are practically identical. It may be said that the flat phase is simply a deeper and smoother phase of the typical soil.

Houston black clay, flat phase, to a depth ranging from 12 to 18 inches, consists of black or very dark grayish-black calcareous clay which grades into dark-gray calcareous clay slightly lighter in color than the material above, and this becomes gradually lighter colored

with increase in depth. Yellow or grayish-yellow marl lies at a depth ranging from 5 to 10 feet beneath the soil material. Several flat strips of this soil adjacent to some of the large streams appear to be high old stream terraces. As the soil has no coarse sedimentary material beneath it appears that these bodies of black land have been developed in place from the underlying marl.

The land is flat, and drainage is slow, but as a rule water does not stand sufficiently long to injure crops.

The same crops are grown, and yields are approximately the same as on typical Houston black clay. There is very little run-off or erosion, and this soil probably is somewhat more drought resistant than the sloping fields of the typical soil. Probably organic matter is more abundant, and on the whole slightly higher yields of crops are obtained in seasons of low rainfall than on many fields of the typical soil, especially on the steeper slopes.

This soil occurs in only a few areas lying near some of the larger creek valleys in the blackland prairie a few miles west of Lott and Rosebud and just east of Perry and Eddy. Most of this soil occurs in association with large bodies of the typical soil, and practically all the land is in cultivation.

Houston black clay, gravelly phase.—Houston black clay, gravelly phase, is identical with Houston black clay in all characteristics, except that it contains loose gravel in small quantities both on the surface and in the surface soil. The gravel are round, about an inch in diameter, and are siliceous. Their presence does not interfere with cultivation. This soil occurs in four small areas in the southwest corner of the county.

Houston clay.—Houston clay is closely associated with Houston black clay, but it occupies the more steeply sloping and rolling areas of the blackland prairie. It is extensive. It is less dark than Houston black clay, less deep in development of soil layers, has about the same heavy structure characteristics, and where poorly managed is subject to greater losses by erosion, owing to the more steeply sloping surface. It is a productive, valuable soil but is somewhat less productive than the black clay.

The surface soil of Houston clay consists of brown calcareous clay from 6 to 12 inches thick. It is very heavy and sticky when wet, cracks deeply on drying, and the soil mass separates to fine grains when thoroughly dried, giving a friable loamy pulverulent mass 2 or 3 inches thick in cultivated fields. The surface soil grades below into yellow crumbly calcareous clay which, in turn, grades, at a depth ranging from 2 to 5 feet, into gray and yellow shaly marl. In the extreme western part of the county small areas of the soil are underlain by chalk at a depth ranging from 2 to 5 feet. The soil material in such locations is highly granular and friable when dry, and the color of the subsoil is more generally grayish brown than yellow.

Houston clay is a rolling prairie soil having slopes sufficiently steep to allow severe washing where not protected. In the production of row crops, such as cotton and corn, where clean cultivation is practiced, the soil in many fields is washed excessively and is very thin and of low productivity. As a large quantity of rain water is lost through run-off, the soil is less drought resistant than Houston black clay. Where terraced the soil is held from severe

washing and becomes more productive. Small grains and sorghums protect the soil to considerable extent, and strip cropping in some sections has proved advantageous.

Houston clay occurs in many small and comparatively narrow strips associated with Houston black clay and is farmed in conjunction with that soil. It is suited to about the same crops but has slightly lower productivity, especially on some of the steeper slopes where erosion has removed much of the topsoil.

Houston clay, colluvial phase.—Houston clay, colluvial phase, is similar to the flat phase of Houston black clay. The surface soil is brown rather than black, and the subsoil ranges rather widely in character but differs from Houston clay in the absence of the marl at a slight depth and the presence of materials that have been deposited by water from small wet-weather streams carrying materials from higher lying land. Its character varies with the character of the source materials, but most of these are fine-grained materials which may or may not contain carbonate of calcium. This is a soil of small extent, but its productivity is somewhat higher than that of the soil on the hills, whence the material came.

Bell clay.—Bell clay is a deep dark calcareous clay soil that has been developed on calcareous soil materials occupying high ancient stream terraces which are no longer overflowed. The 12- to 18-inch surface soil is black or very dark gray calcareous clay passing downward with little change, except that the color becomes slightly lighter with increase in depth. This material is underlain by gray or dark-gray clay, and this, in turn, grades, below a depth ranging from 3 to 5 feet, into yellow calcareous clay. Beds of rounded gravel lie beneath this soil, in most places at a depth of several feet (pl. 1, *A*). The surface soil when wet is very sticky, but on drying the material separates to fine particle aggregates that give a loose friable consistence in cultivated fields.

The surface relief is in general nearly flat, although in places it is undulating. Surface drainage is slow, and underdrainage also is rather slow where the gravel beds lie at a great depth beneath the surface. Natural drainage, however, is adequate for the successful use of this land for all the general-farm crops.

Bell clay occurs in a number of good-sized bodies in the Brazos Valley, especially on the flat areas west of the stream. It is not so extensive as Houston black clay or Houston clay. In general appearance the soil is similar to Houston black clay, flat phase. Possibly it has slightly better underdrainage than Houston black clay, and it is probably, on the whole, a more generally valuable soil. The same crops are grown as on Houston black clay, and yields are about the same as those produced on the smooth parts of the black clay. Good water is obtained in shallow wells on many areas of Bell clay. Practically all of this land is under cultivation.

Lewisville clay.—Lewisville clay has a 10-inch brown crumbly calcareous clay topsoil which grades into lighter brown calcareous crumbly clay. Below a depth of 30 inches this material grades into soft friable yellowish-brown or buff calcareous clay containing lumps of white calcium carbonate. In many places beds of rounded gravel occur at a depth ranging from 5 to 6 feet.

This soil has the same color and general physical characteristics as Houston clay. It occupies sloping areas on the high old terraces,

on which the large bodies of Bell clay occur, and the Lewisville soil represents an immature stage of the Bell soil. It contains less organic matter, is lighter in color, and has thinner soil layers. On the whole it is less productive than Bell clay, with which it is associated. The surface soil, although heavy and sticky when wet, dries to a friable mass composed of small-particle aggregates.

Lewisville clay is a soil of small extent, occurring only in narrow sloping areas. It is subject to erosion unless carefully managed, and it should be protected to prevent exhaustive washing. The same farm crops are grown as are produced on Houston black clay, but yields are considerably lower. The Lewisville soil is better suited to small grains and sorghum or other feed crops that can be sown broadcast, rather than to the clean-tilled row crops which allow rapid erosion. Some native pecan trees grow on this soil, indicating that it is fairly well suited to these trees.

Crockett clay loam.—The 6- to 10-inch surface soil of Crockett clay loam is dark-brown or nearly black clay loam. It grades into brown heavy clay which, below a depth ranging from 24 to 30 inches, is light-gray shaly clay containing yellow spots and some white concretions. The surface soil and subsoil materials are not calcareous. The topsoil breaks down to fine particles and is moderately friable in cultivated fields. The subsoil, although heavy, is moderately permeable and is not of claypan character.

Crockett clay loam has been developed from parent materials that are less limy than those of the Houston soils. The Crockett soil is somewhat less heavy in texture than Houston black clay and is less friable. It occurs in gently rolling areas and is subject to some erosion. The same crops are grown as are grown on the Houston soils, but yields are somewhat less than on Houston black clay. The Crockett soil is not extensive. It occurs in a number of small widely scattered areas throughout the prairie lands, in many places where the dark heavy soils and sandy timbered soils adjoin. It is considered a valuable moderately productive soil well suited to cotton, sorghums, corn, grasses, and most of the feed crops.

TIGHT HEAVY DARK-COLORED UPLAND SOILS

This group comprises three soils of considerable extent—Wilson clay loam, Wilson clay, and Irving clay loam—which have been developed on very smooth prairies and old river terraces from marls or clays that are somewhat calcareous but less limy than the parent materials of the Houston and Bell soils. These soils have nearly black or dark blackish-gray topsoils resting sharply on tough rather dense clay subsoils. The surface soils and upper subsoil layers contain no appreciable quantities of calcium carbonate. On drying, the topsoils pack to a hard tight crusty mass and the subsoils become dense, hard, and almost impervious to water. The Wilson soils have been developed from clays or marls and the Irving soils from old stream sediments of ancient terraces underlain to a great depth by beds of gravel.

These soils are locally termed "black land" by many farmers, although they recognize differences in the physical character and less favorable seedbed conditions of the soils. They are less readily cultivated than the Houston soils, and they dry out to such

a hard tight mass that cultivation becomes difficult and leads to the general term of "rawhide land" or "tight land."

Wilson clay loam.—The 10-inch topsoil of Wilson clay loam is dark-gray heavy clay loam which is rather sticky when wet but is tight, hard, and crusted in places where it has dried without cultivation. This layer rests sharply on heavy tough dense gray clay of claypan character. Neither topsoil nor subsoil has an appreciable content of calcium carbonate. At a depth ranging from 2 to 3 feet, the subsoil grades into yellow or mottled yellow and gray calcareous clay containing some white concretions of calcium carbonate and some fine black pelletlike concretions.

Although some areas of this soil are undulating, the surface relief as a rule is smooth and nearly flat, thereby affording slow surface drainage, and the dense subsoil causes very slow underdrainage. Drainage, however, in most places is adequate to allow cultivation, and practically all of this land is devoted to farm crops. Although somewhat less easily cultivated than the Houston soils, it is considered a valuable and fairly productive soil. It occurs in a number of small and some good-sized bodies, and many farms are composed largely or entirely of this soil. If cultivated when too moist the soil dries out to large intractable clods but if allowed to become too dry, cultivation is almost impossible. By working the soil when moisture conditions are correct, a 1- or 2-inch surface layer of coarse-grained aggregates and fine clods is maintained in cultivated fields.

Wilson clay loam is used for the general-farm crops. Difficulties of cultivation are greater than on the more friable heavy soils of the Houston series. Replanting of crops is sometimes necessary, owing to crusting over of the topsoil, which prevents germinating plants from coming through.

The principal crops grown are cotton, grain sorghums, sorgo, Sudan grass, and some oats. The soil is well suited to all these crops, and yields in seasons of favorable moisture conditions are approximately the same as those obtained on Houston black clay. According to local reports crop yields in normal seasons are as follows: Cotton about one-half bale an acre, corn from 15 to 35 bushels, and oats from 30 to 70 bushels, with considerably higher yields during some seasons of especially favorable rainfall. Cotton root rot affects and kills cotton on this soil to some extent, but, in general, the fields seem to be less infected by this disease than fields on the Houston soils.

Some vegetables, tree fruits, small fruits, berries, and various truck crops grow well in the well-cared-for home gardens and orchards, and these products are grown chiefly for home use.

In places small spots of salty soil, locally known as "alkali", occur. It is probable that this salty condition, which causes unproductiveness in many of the small spots, can be ameliorated or largely overcome by some form of correct drainage, together with the addition of a rather large quantity of organic matter or barnyard manure.

Wilson clay.—Wilson clay differs from Wilson clay loam chiefly in that the topsoil is of clay texture and therefore heavier, denser, and more intractable. It consists of dense black or dark-gray clay grading below through a short transitional zone into gray noncalcareous clay which at a depth of about 4 feet grades into light-gray

A, Soil profile of Bell clay. *B*, A flock of turkeys on Crockett fine sandy loam.

A, A field of cotton on Catalpa clay. *B*, Native pecans on Ochlockonee fine sandy loam

waxy clay. This clay, although not everywhere calcareous, contains some fine concretions of calcium carbonate and in places is decidedly calcareous below a depth ranging from 3 to 4 feet. Marl lies several feet beneath the surface. On drying thoroughly, the topsoil and subsoil become very hard and compact, and the material cracks into irregular hard dense clods.

The surface soil and subsoil allow very slow passage of water, and aeration of the mass is deficient and root penetration difficult.

When cultivated under the proper moisture content a thin fine-cloddy topsoil layer is established.

This soil occurs mostly in very flat areas. Therefore both surface drainage and underdrainage are very slow, and considerable time is required for the more nearly flat areas to dry out satisfactorily for cultivation.

Most of this soil is in the northeastern part of the county. It is considered a productive soil which is of less favorable physical character than most other soils of the county. It is largely cultivated and devoted to the production of the farm crops commonly grown, possibly having a better adaptation for oats than for cotton or corn. Yields are about the same or perhaps slightly less than on Houston black clay. The farmers report that cotton yields an average of about one-half bale an acre, corn from 20 to 30 bushels, and oats from 30 to 70 bushels.

Irving clay loam.—Irving clay loam is very similar in character to Wilson clay loam. It occupies flat terrace benches of old sedimentary stream deposits superimposed on beds of rounded gravel which lie several feet beneath the surface. Owing to the fact that it lies high above overflow, the parent material of ancient alluvium has been developed into soil having very much the same features and physical character as the Wilson soils. It has a tendency to assume a tight crusted condition when thoroughly dry.

The 10-inch surface soil is dark-gray noncalcareous heavy clay loam which, when air-dry, is tight and dense, but if cultivated under the proper moisture condition it may be worked into a shallow layer of fine clods and coarse grains. This material grades very sharply into dense gray clay which is also noncalcareous and of such structure as to allow very slow underdrainage. Below a depth of about 30 inches this material, in turn, grades into slightly lighter colored gray tough clay which, although not calcareous, contains some fine concretions of calcium carbonate, increasing in number with increase in depth. In places the beds of rounded gravel and sand lie from 6 to 10 feet beneath the surface, and in other places, according to local report, the depth to this coarse material is 35 feet. Although underdrainage through the clay subsoil is slow, the coarser sedimentary beds afford some drainage and also provide a reservoir of water which is obtained in many places in shallow wells. Surface drainage is very slow, but the natural drainage is sufficient to allow successful cultivation, and practically all the land is used for the production of the general farm crops.

This soil occurs in a number of good-sized areas in the southern part of the county, some near Rosebud and some west and north of Reagan. Cotton, corn, sorghums, oats, and the general feed crops are

grown, and yields are as good as or slightly better than on Wilson clay loam which the Irving soil closely resembles.

DARK-COLORED SANDY UPLAND SOILS

Although the dark-colored heavy upland soils predominate in this county, there are some important scattered small and large bodies of associated dark soils of sandy texture which have heavy subsoils and other similar features but, owing to the fact that the topsoils are of lighter texture, the soils are discussed as a separate group. The soils comprising this group are Crockett fine sandy loam, Falls fine sandy loam, Wilson fine sandy loam, Irving fine sandy loam, and Riesel fine sandy loam. These dark-colored sandy upland soils comprise an important group because of their peculiar crop relationships, which also set them apart from the heavy dark-colored soils and from the light-colored sandy upland soils.

Wilson fine sandy loam.—The 8- to 10-inch surface layer of Wilson fine sandy loam is dark ash-gray (blackish-gray when moist) fine sandy loam containing no free calcium carbonate. It is moderately heavy, contains some clay and silt, and on drying has a tendency to form a tight hard crust, in conformity with the characteristic tendency of the Wilson soils. In dry, hot weather the uncultivated soil becomes exceedingly hard. If plowed under favorable moisture conditions the soil works into a friable loamy mass of single-grain particles. This material grades into a 4- to 8-inch layer of light-gray fine sandy loam containing fine brown spots. The material dries out and cracks to form wedge-shaped plates of soil and passes below through a short transitional zone or rests on the subsoil which consists of dense tough dark-gray clay containing a few rust-brown spots. At a depth of about 3 feet, this material grades into light-gray brittle clay containing yellow spots and, as in all the layers above, this material is noncalcareous but contains a few small concretions of calcium carbonate and a few fine black concretions.

Although the surface relief ranges from flat to undulating, the slow natural drainage is sufficient to allow the land to be successfully used for cotton, corn, and the common feed crops of sorghums and grasses. Corn yields from 15 to 30 bushels an acre and cotton an average of about one-fourth or one-third bale. Some oats are grown and afford good pasturage, but yields of grain are not high or even moderately good unless there is abundant rainfall. Vegetables and orchard fruits do fairly well in the better attended home gardens and orchards and furnish adequate quantities of these products for home and local requirements. Berries and small fruits do moderately well.

Practically all this land is in cultivation, as it is considered a fairly productive and satisfactory soil. Sometimes, when the soil crusts over on drying and prevents newly planted crops from coming up, it is necessary to replant.

Because of the generally smooth surface relief, erosion is not severe, but in some places terracing would be valuable in protecting the soil from washing and in conserving run-off water. This soil responds to the addition of organic matter and barnyard manure.

Irving fine sandy loam.—Irving fine sandy loam has about the same texture, color, and structure as Wilson fine sandy loam. It is, however, a soil developed from old alluvium on beds of sand and gravel and differs from the Wilson soil, in that it has somewhat better underdrainage and a water table near enough to the surface to provide well water for the farms. The surface soil consists of dark-gray fine sandy loam from 8 to 12 inches thick. It grades into or rests on dense gray clay, and this, in turn, is underlain, at a depth of several feet, by beds of sand and water-worn gravel.

This soil occurs in small areas, some of the larger of which are around Marlin, around Perry, and some west of Reagan. Crop adaptations and yields are about the same as for Wilson fine sandy loam, perhaps slightly better in places.

Crockett fine sandy loam.—The 12- to 15-inch surface soil of Crockett fine sandy loam is light-brown loamy fine sand. It is not calcareous and when moist is of a blackish-gray color. This material grades into heavy mottled gray, yellow, and red clay which is noncalcareous, rather crumbly when moist, and not so dense as to cause deficient aeration or underdrainage. Below a depth of about 30 inches, the material is yellow and gray mottled noncalcareous clay which grades, at a depth of about 50 inches, into parent material of yellow noncalcareous fine sandy clay.

This soil occurs in some good-sized areas in the southern part of the county, some areas not far from Chilton, and some in the southeastern and eastern sections.

The surface relief is undulating or very gently rolling, and drainage is good. Although originally prairie land, virgin areas support some mesquite trees. In places the subsoil is red or brownish-red clay with no gray mottlings.

About 65 percent of the land is devoted to crops, and this is considered a fairly good soil for the general-farm crops. In normal seasons average yields are about the same as those on the other dark sandy soils. Corn ordinarily yields from 20 to 25 bushels an acre, and cotton yields one-fourth or one-third bale on the better fields of the well-cared-for farms. Some oats are grown, more extensively for pasturage than for threshed grain. In good seasons yields ranging from 20 to 40 bushels are produced. The soil is well suited to fruits, berries, and vegetables, which are produced in abundance, for local and home use, in the small home orchards and gardens on many farms. The productivity of the soil can be improved by adding organic matter and barnyard manure.

Plate 1, *B*, shows a flock of turkeys in a field of Crockett fine sandy loam.

Falls fine sandy loam.—Falls fine sandy loam in its general features holds a position midway between the fine sandy loams of the Crockett and of the Wilson series. It is dark ash-gray fine sandy loam to a depth ranging from about 12 to 15 inches, at which depth it is abruptly underlain by dull-gray dense clay containing red, yellow, and brown spots and streaks, and all the colors merge with one another and with the gray. Small black concretions are present. Below a depth of about 30 inches the clay is less mottled and consists of dull-gray heavy clay containing almost white particles which appear to be gypsum. Neither surface soil nor subsoil is calcareous,

although sandy marl occurs at a depth of several feet. The topsoil dries out to a rather hard mass, but the tendency to crust is less marked than in the Wilson soils.

This soil occurs in good-sized areas south of Chilton and east of Reagan. The surface relief is undulating, and the land slopes sufficiently to allow free surface drainage, although the heavy subsoil allows but slow underdrainage and only moderately good access to air and plant roots.

Practically all the land is in cultivation. It is considered a good soil for the general-farm crops and is fairly suitable for fruits, vegetables, and berries. According to local reports, it is slightly more productive than Wilson fine sandy loam, but for fruits and vegetables it is considered slightly less suitable than Crockett fine sandy loam. It is utilized chiefly for the production of cotton, corn, and various feed crops, mainly the sorghums and Sudan grass.

Riesel fine sandy loam.—Riesel fine sandy loam consists of dark grayish-brown or blackish-gray heavy fine sandy loam to a depth of about 10 inches. It grades into dull reddish-yellow tough clay which contains a few water-worn pebbles. Below a depth of 20 inches, this material grades into tough heavy clay mottled with red, gray, and yellow, which extends downward several feet and rests on marl. The surface relief ranges from undulating to rolling, and drainage from good to exhaustively eroding on some of the steeper slopes. This soil appears to be developed from very old alluvium deposited on the marl of the high prairie lands and therefore lies as high as or higher than some bodies of Houston soils. The Riesel soil occurs in only a few small areas near Perry, but it is apparently more extensive in the adjoining McLennan County.

Rounded chert gravel and other small pebbles in both the surface soil and the subsoil indicate the water-laid origin of the parent material. Underdrainage is poor. Most of the land is uncultivated, and some post oak trees are growing on it. The soil is probably about as suitable for crops as is Reagan fine sandy loam.

ALLUVIAL SOILS

Within the group of alluvial soils are included all of those developed in the stream bottoms of the county. They are formed from water-laid materials that have been transported by stream water from upland areas. This grouping is not based altogether on physical characteristics or on origin but is used to distinguish and set apart the most generally highly productive soils so far as inherent fertility is concerned. These soils occur along the various streams, in areas of different widths, conforming to the relative size and length of the streamway and to the extent of its drainage basin. A rather heavy growth of timber, including largely elm, ash, hackberry, water oak, and other trees, originally covered these soils, and in places native pecan trees were abundant. The soils, however, are now largely in cultivation, owing to their inherent value for producing good crop yields. They are subject to occasional overflows, but on the whole drainage is adequate for successful farming, although some low-lying areas nearest the uplands are of heavy texture and have very slow natural drainage.

The alluvial soils are grouped, largely on the basis of their color and profile arrangement, into series, and the series are separated, according to the texture of the surface soil, into soil types. In the Brazos River flood plain the two principal series, the Miller and Yahola, include soils composed of reddish-brown calcareous soil materials transported from the "Red Beds" of northwestern Texas. The Miller soils have subsoils heavier than the topsoils—the normal and usual arrangement of soil layers—and the Yahola soils, owing to peculiarities of sedimentation have the reverse arrangement, with the subsoils lighter in texture than the topsoils.

In the bottoms along the streams draining the blackland prairies, the soil materials are dark, calcareous, and for the most part heavy in texture. The brown soils are included in the Catalpa series and the black soils in the Trinity series. In places where the local blackland drainage sedimentation comes in contact with the Brazos River deposits, there are areas having black topsoils over red subsoils, and these are correlated as the Pledger soils. In some small narrow bottoms of streams draining the light-colored sandy soils, the soil materials are brown, are of acid reaction, and are largely siliceous. These soils are included in the Ochlockonee series.

Owing to the smooth deep friable and permeable surface soil and subsoil layers, which favor the collection and retention of soil moisture, the water relationships for growing plants are unusually favorable, and crops do well, even in very dry seasons. In addition, the large proportion of available plant nutrients favors good yields. Therefore the alluvial soils constitute a very important part of the agricultural land in the county and are utilized very extensively.

Miller clay.—The 10-inch topsoil of Miller clay is chocolate-red crumbly calcareous clay which grades into slightly brighter red calcareous crumbly clay extending downward several feet and grading into the more sandy layers of earlier sedimentation. In low slightly depressed portions on the outer margins of the bottoms, however, the Miller clay topsoil consists of rather heavy chocolate-red clay which appears to contain a larger percentage of clay particles and less silt than occurs elsewhere. Below a depth ranging from about 20 to 24 inches these poorly drained areas have red clay subsoils slightly mottled with gray.

The topsoil of Miller clay works into a friable loamy condition in cultivated fields, but it becomes very hard and deep cracks form during very dry, hot seasons. The surface relief is flat, and underdrainage is fairly good over large areas. Occasional overflows occur, but crops are rarely lost through this cause. As a rule, a large part of this land has adequate natural drainage to allow successful production of many farm crops. It is used largely for cotton, and some corn, sorghums, and oats are grown. Miller clay is a strong naturally productive soil, and average yields of farm crops are higher than on most of the other soils of the county.

Nearly all of Miller clay is cultivated. It is utilized chiefly for producing cotton on large farms and plantations in the Brazos River bottoms, where it is extensively developed. In favorable seasons 1 bale or more of cotton an acre has been produced, and this normally can be expected in places where the soil is free of such unfavorable modifying conditions as inadequate drainage in wet seasons, insect

injury, and other factors which tend to lower production. Practically no cotton root rot occurs on this or the other alluvial soils, even though these soils are calcareous and their reaction to acid tests is similar to that of the upland soils on which cotton root rot is very injurious.

Cotton probably averages three-fourths of a bale an acre, but in some years bollweevil infestation of this crop is exceedingly severe on this and on other alluvial soils. The heavy foliage produced in wet seasons apparently shelters and harbors this insect. Corn averages about 40 bushels an acre, and oat yields range from 40 to 75 bushels. The better drained areas are well suited to alfalfa which yields from 3 to 6 tons an acre. Some native pecan trees produce good yields of nuts, but in many places the underdrainage is not sufficiently free to allow the best growth of these trees, as compared with the growth of some others on the associated alluvial soils. Excellent yields of sorghums and various feed crops are produced.

Yahola clay.—Yahola clay is a rather extensive soil of the Brazos River bottom lands and is closely associated with Miller clay. Most of it lies slightly higher than Miller clay and has better surface drainage and much freer underdrainage than that soil.

The 12-inch surface soil of Yahola clay is dark chocolate-red calcareous silty clay which is crumbly when moist and on drying separates naturally to fine-grain particles, producing a mass of loamlike material. This grades into a chocolate-red calcareous silty clay subsoil which is crumbly, permeable, and extends to a depth ranging from 20 to 30 inches, although in places this layer may be less than 6 inches thick. This material, in turn, passes into lighter textured soil material which varies from place to place. It may be light-red very fine sandy loam, silty loam, or silty clay loam to a depth of several feet, and in other places there are irregularly thin or thick layers of different-textured soil materials, ranging from clay to very fine sand, extending to a depth of several feet. Most of the material is very fine sandy loam.

The surface relief is nearly level, and both surface drainage and underdrainage are good. This soil is very productive, and the free underdrainage facilitates and enhances its natural productivity. In spots where the lighter textured subsoil material lies near the surface, however, the productivity is less than in places where the heavy topsoil and subsoil layers are thick.

This soil is well suited to the same crops as those grown on Miller clay, and, owing to the better conditions of drainage, yields are as large as or larger than on that soil in some fields. It seems that Miller clay, owing to its heavier texture throughout, has a larger capacity for long-continued good yields. Pecan trees do well on Yahola clay, and in many places the native trees are left in the cultivated fields in order to increase the farm income by the sale of nuts. Because of its advantageous natural drainage, probably most of this soil is better suited to pecans and to alfalfa than is Miller clay. Most of the soil is devoted to cotton on the large plantations, and some corn and oats are grown.

Yahola fine sandy loam.—The topsoil of Yahola fine sandy loam is chocolate-brown or reddish-brown calcareous fine sandy loam or loamy fine sand extending to a depth ranging from 10 to 18 inches.

It grades into gray, buff, or reddish-yellow calcareous fine sand or loamy fine sand, which continues to a depth of many feet. This is an alluvial soil of the Brazos River Valley, where it occupies the higher lying bottom lands, mainly along the banks of the main stream or along sloughs and creeks, which extend through the bottoms. It is closely associated with Yahola clay and is farmed in fields composed almost entirely of Yahola clay and Miller clay.

Although the surface soil is light textured and the subsoil still lighter and looser, this soil is moderately productive, especially in years of considerable rainfall. Most of the land occurs in strips which follow the courses of the drainageways. In many places the native pecan trees remaining provide an appreciable revenue from the sale of the valuable nut crop. Doubtless the suitability of this soil for pecan trees is largely owing to the permeable surface soil and subsoil materials which allow free access of air, moisture, and roots; to the free underdrainage which does not allow water-logging around the roots; and to the high water table which affords the large quantity of moisture required for tree growth and nut production.

Most of the soil is used for cotton which produces an average of one-half bale or more an acre. In very favorable seasons the heavier and deeper phases of the soil produce a much higher yield. Corn produces from 25 to 50 bushels an acre, and alfalfa does well but not so well as on the heavier soils. The land is well suited to peaches, plums, grapes, watermelons, peanuts, and many vegetables and berries, and these products are grown to some extent for home use and local markets.

Included in mapped areas of this soil, but not shown on account of their small extent, are small bodies of Yahola fine sand and Yahola loamy fine sand. Such areas are of much lower productivity. Yahola fine sandy loam differs considerably from place to place in its content of silt and clay. The productivity of this soil is higher in places where the content of finer soil particles is greatest in both the surface soil and subsoil.

Trinity clay.—Trinity clay is black or nearly black heavy calcareous clay which is very sticky when wet, crumbly when moist, and on drying separates to fine-grain aggregates, giving a friable topsoil layer in cultivated fields. This layer is underlain by dark-gray calcareous clay of about the same character, although, below a depth of about 12 inches, the material is less dark than that above, owing to the presence of finely divided organic matter in the surface soil. The clay extends to a depth of several feet.

This soil occurs in narrow strips in the bottoms of the larger creeks which drain the blackland prairie soils. The surface relief is flat, and the land lies but a few feet above the streams and is susceptible to overflows. Although the water runs off slowly, natural surface drainage and underdrainage are so slow that much of the soil is saturated with water for long periods. Some of the land is cultivated, but much of it remains with its original cover of trees, among which elms predominate. Native pecan trees grow only along stream banks, where drainage is good. With protection from overflows and adequate drainage, this soil would be very valuable for the production of cotton, corn, sorghums, and grasses, and it would also be suited to alfalfa. The small areas in cultivation in Falls County yield from one-half to 1 bale of cotton an acre and from 40 to 50 bushels of

corn. In some counties where large areas of this soil occur, excellent yields of cotton, corn, and alfalfa are produced in the larger stream bottoms, in places where drainage is adequate.

Pledger clay.—The topsoil of Pledger clay is heavy black calcareous clay from 4 to 10 inches thick. It grades into reddish-brown or chocolate-brown calcareous heavy clay which extends to a depth of several feet. This soil occurs in bottom-land areas where blackland prairie streams have deposited dark soil materials on the red calcareous sediments from backwater overflows of Brazos River. In its virgin condition the soil cracks deeply on drying, and hog wallows form on the surface.

This soil is very similar in surface appearance to Trinity clay and like that soil occurs in positions where overflows of local streams constitute a hazard in the production of cultivated crops. Therefore not much of the land is farmed but remains mostly in native timber consisting largely of elm and hackberry trees. Some buffalo grass affords excellent pasturage in places where the trees are not thick. The soil is highly productive and, in places where drainage is adequate, is especially suited to cotton, corn, and various feed crops including alfalfa. This is not a very extensive soil.

Catalpa clay.—Catalpa clay is brown or grayish-brown heavy calcareous clay to a depth of several feet. The material in the topmost 8 to 12 inches is slightly darker than that beneath, owing to the larger content of finely divided organic matter. In places in the subsoil there are thin layers of lighter textured soil materials, indicating the alluvial deposition of soil materials washed mainly from heavy dark-colored prairie soils, with a slight admixture of sandy materials from local sandy upland soils.

This soil occurs along some of the larger creeks and has fairly good drainage, although the land is sometimes overflowed. Although it closely resembles the Trinity soils in inherent productivity, it is naturally better drained and therefore lies more favorably for cultivation. Crop yields are about the same as on Yahola clay and Miller clay. Most of the land in cultivation is used for the production of cotton (pl. 2, *A*) and corn. The soil is readily worked into a seed bed of good tilth, and it dries out to a mass of fine grains in cultivated fields.

Catalpa clay loam.—The 10-inch topsoil of Catalpa clay loam is brown calcareous clay loam or silty clay loam. It is underlain by calcareous clay or clay loam which extends to a depth of several feet. In places thin layers of somewhat lighter textured material occur, and on the whole the material below a depth ranging from 5 to 6 feet contains sufficient fine sand to afford good underdrainage. The land is almost flat, although most of it slopes sufficiently to insure ready drainage. Overflows occur, but the water usually remains but a short time, and as a rule a large proportion of the land is used for the production of cotton and corn, to which it is well suited.

The soil is very productive, and crop yields are about the same as or slightly lower than those produced on the Yahola, Miller, and Catalpa clays. Native pecan trees grow abundantly, probably largely because of the excellent underdrainage and also because of the very favorable conditions of a high water table for furnishing a large quantity of available moisture. This soil would produce excellent yields of al-

falfa, sorghums, and other feed crops. The land is largely in cultivation to the general farm crops, mainly cotton.

Narrow areas of Catalpa fine sandy loam are included with Catalpa clay loam in mapping, as they are too small to show separately on a small-scale map.

Ochlockonee fine sandy loam.—Ochlockonee fine sandy loam consists of brown or light-brown fine sandy loam to a depth of about 12 inches, where it grades into yellow or yellowish-brown fine sandy loam or fine sandy clay loam. At a depth of about 2 feet the material is gray fine sand or fine sandy loam, and in places dark-gray clay or mottled gray and yellow sandy clay. This soil occurs in narrow stream bottoms as an accumulation of water-laid soil materials washed from the local light-colored sandy upland soils. The texture and color of the subsoil differ from place to place, in accordance with conditions of drainage and lack of uniformity of deposition by stream action. This soil is not calcareous. It has fair surface drainage and underdrainage and, although not an extensive soil is cultivated to some extent. Its occurrence in narrow stream bottoms along small streams renders it subject to frequent overflows in many places.

This soil is suited to the production of cotton and corn. Yields of cotton range from about one-half to three-fourths bale an acre, and corn averages about 30 bushels. In the better drained areas, native pecan trees (pl. 2, *B*) are numerous. Bermuda grass is a valuable pasture crop where allowed to grow on this soil. In places a fine quality of sirup is made on the farms from sugarcane grown on this land. The well-drained areas are suited to vegetables and small fruits.

LIGHT-COLORED SANDY UPLAND SOILS

The light-colored sandy upland soils occur mainly in an area in the extreme eastern part of the county where, as the westerly extension of the east Texas timber country, they occupy a body including several timberland soils of fairly closely related characteristics. These soils are chiefly the products of soil development from the noncalcareous unconsolidated formations of the Eocene epoch, although some small outlying strips or benches adjacent to the stream valleys have been developed from recent alluvium.

These light-colored soils are characterized by loose surface soils and clay subsoils of varied character, and chiefly on the basis of differences in subsoil characteristics the separation into soil types is made. These soils are slightly or moderately acid in reaction, are low in organic-matter content, low in some of the essential plant nutrients, are of only moderate productivity, and have somewhat limited adaptability to crops. A characteristic growth of oak timber on them is a feature of the western border of the great coastal-plain belt of sandy timberlands reaching from New Jersey to Texas. These soils for the most part are used for the production of the general-farm crops common to this locality.

Milam fine sandy loam.—The 15-inch surface soil of Milam fine sandy loam consists of light-brown loose loamy fine sand which grades into red crumbly fine sandy clay. With increase in depth, the subsoil material becomes less red and assumes a yellowish-red color. It rests on beds of rounded gravel or gravelly sand, lying at

a depth of several feet beneath the surface. Both topsoil and subsoil are friable and permeable, and this condition facilitates aeration and underdrainage and allows easy penetration of plant roots.

The surface relief ranges from undulating, in most places, to gently sloping along the edges of high terraces, generally on the outer margins, where the terraces rise from the adjacent lower lying overflow bottom lands.

Milam fine sandy loam is a soil of slight extent, and it occurs in a few small bodies on the high terraces adjacent to the Brazos River flood plain. It has been developed from old sandy alluvium of Brazos River deposited when that stream flowed at a higher level. The underlying beds of sand and gravel provide a good reservoir for underground water which is available in shallow wells.

This soil is of only moderate inherent productivity and is only moderately well suited to the general-farm crops, but it is excellent for vegetables, orchard fruits, grapes, berries, watermelons, sweetpotatoes, peanuts, and various other truck crops. Cotton, corn, and sorghums are well adapted to this soil, and with some fertilization they return very good yields. The soil responds well to commercial fertilizers, and to the application of organic matter and barnyard manure. Well-cared-for fields of this soil in some localities of central-eastern Texas produce one-half bale of cotton, from 20 to 25 bushels of corn, and from 20 to 30 bushels of grain sorghums to the acre. Complete fertilizers containing a rather high percentage of nitrogen and phosphoric acid appear to be the ones most desirable for this soil. The land is largely in cultivation, but there are some areas still in original forest of post oak, blackjack oak, and hickory. Wild grapevines are abundant.

Norfolk fine sand.—In virgin areas Norfolk fine sand comprises a thin topsoil layer 3 or 4 inches thick of light-gray loose fine sand which grades into pale-yellow fine sand continuing to a depth of several feet. With cultivation and the gradual deeper accumulation of organic matter resulting from tillage, the gray topsoil layer becomes 8 or 10 inches thick. This soil is exceedingly loose and contains only a slight amount of organic matter. It is rather deficient in nitrogen, phosphorus, and possibly some other essential plant nutrients. It responds readily to fertilization, not only to the addition of commercial fertilizers but also to organic matter and barnyard manure.

This soil occurs in a few small areas in the wooded section of the eastern part of the county, where most of it is still covered by a native growth of blackjack oak, post oak, and hickory.

The soil is not highly productive and is not well suited to the general-farm crops—cotton, corn, and oats—but it produces fair yields of watermelons, peas, peanuts, sweetpotatoes, and various other vegetables. It is well suited to these crops, also to small fruits and berries. It is of somewhat lower productivity than Milam fine sandy loam.

Susquehanna fine sandy loam.—The surface layer of Susquehanna fine sandy loam is light-gray fine sand about 3 inches thick. It grades into yellow fine sand which extends to a depth ranging from about 10 to 15 inches. Where cultivated, the gray surface layer is about 8 inches thick, owing to the incorporation of organic matter.

The sand layer grades sharply below into heavy, dense red clay containing mottlings of gray, and below a depth of about 20 inches it consists of mottled red, gray, and yellow fine sandy clay. This material is underlain, at a depth of about 3 feet, by the parent material of yellow and gray mottled clay. Areas of this soil range from undulating to rolling. Surface drainage is in places rapid and causes severe washing and gullying. The soil is not developed to a great depth, and the parent material lies near the surface on some slopes.

Susquehanna fine sandy loam is not very extensive in this county. It occurs chiefly in the eastern part within the wooded area of sandy soils occupied by post oak, blackjack oak, and hickory. Large areas lie farther east of Falls County.

The soil is similar to Milam fine sandy loam in crop adaptations, but it is less productive, as it is leached and eroded to a greater depth. Only a small proportion of it—perhaps 15 percent—is in cultivation. It is fairly well suited to vegetables, fruits, berries, and grapes, and to less degree to cotton, corn, and the sorghums. The soil responds readily to applications of commercial fertilizers, organic matter, and barnyard manure.

Moderate yields of truck crops and feed crops can be obtained if the land is carefully handled. To preserve it and build it up to capacity for producing, it should be terraced to prevent erosion and should be enriched with commercial fertilizers, manure, and organic matter plowed under. In places tomatoes for the early market have proved a profitable special crop.

Tabor fine sandy loam.—Tabor fine sandy loam, in its upper layers, closely resembles Susquehanna fine sandy loam. The surface soil consists of a 4-inch layer of gray fine sand which grades into pale-yellow fine sand. At a depth of about 12 inches this material changes abruptly to rather heavy yellow clay which, below a depth of 20 inches, is mottled with gray streaks and below a depth of 30 inches changes to mottled gray and yellow fine sandy clay. At a depth ranging from 4 to 5 feet is the parent material of yellow, gray, or mixed yellow and gray mottled sandy clay.

The surface relief is undulating, and the land is less washed or eroded than Susquehanna fine sandy loam. It is very inextensive and occurs in small spots in the eastern (post oak) section of the county in association with the other light-colored sandy soils. This soil has a more permeable subsoil than Susquehanna fine sandy loam, it is not so eroded, and on the whole is probably somewhat more readily improved than that soil. It is a soil well suited to truck crops, berries, and fruits, and moderate yields of corn and cotton can be grown. The soil produces much better when it is fertilized and organic matter is worked deeply and thoroughly into the surface and subsurface sandy layers.

Leaf fine sandy loam.—The areas of Leaf fine sandy loam differ considerably in subsoil characteristics. To a depth of 4 inches the surface soil consists of gray loamy fine sand which grades into yellow fine sand, and this layer, in turn, at a depth ranging from about 12 to 15 inches, passes through a short transitional zone into heavy mottled clay, in which yellow, gray, and red colors occur in mottled form. In places some one of these colors is absent. The clay extends to a depth of several feet and rests on beds of rounded gravel or sandy water-laid materials.

Near Tomlinson School, several miles west of Marlin, the subsoil in places is dense red clay which, below a depth of 20 inches, is mottled gray and yellow and in most places contains much water-worn gravel. Near Sunset the subsoil is slightly less red and is less dense, and in some of the flatter areas the red color is not present and the heavy clay subsoil is mottled gray and yellow.

This is a fairly extensive soil. It occupies large areas on the high old stream terraces formed from old alluvium carried by Brazos River before it had cut so deeply into the present low-lying flood plain. The surface relief in general is flat or gently undulating, but some slopes are moderately steep. The uncultivated areas support a growth of post oak and blackjack oak trees.

This soil is somewhat similar to Susquehanna fine sandy loam in that it has a dense slowly permeable clay subsoil. It is of approximately the same suitability for crops as the Susquehanna soil, but, as it is less sloping and eroded, it is slightly more productive.

Probably more than half the land is cultivated, and the principal crops are cotton, corn, and sorghums. Some truck crops (largely tomatoes) for the early market have been grown successfully in tracts ranging in size from 1 to 5 acres.

This soil, like other soils of the group, responds well to fertilization and to the addition of organic matter. It is well suited to many of the small fruits, berries, grapes, vegetables, and other truck crops.

MISCELLANEOUS SOILS OF LOW PRODUCTIVITY

In this group are included several soils of minor agricultural value, a condition brought about by soil erosion. Most of these soils are members of series which include soil types already mentioned as being highly productive. The soils of low productivity are widely scattered and in many places are of but slight extent. They occur in numerous small spots associated with valuable farming lands. In many places, for convenience, they are farmed in fields made up largely of highly productive soils.

These soils are as follows: Houston clay, shallow phase; Houston clay, gray phase; Sumter clay; chalk (Houston material); Irving clay loam, shallow phase; and river wash.

Houston clay, shallow phase.—The shallow phase of Houston clay consists of brown calcareous clay of granular structure. In most places, the soil material ranges from 4 to 10 inches in thickness, but in places it is 18 or 20 inches thick. It is underlain by white chalk, some hardened fragments of which in places are mixed with the fine earth material. This soil contains a large quantity of calcium carbonate, which probably accounts for the very friable condition of the soil when it dries and separates naturally to small-grain aggregates.

The surface relief in general is gently or moderately rolling, and some slopes are steep. The soil is subject to exhaustive erosion where not protected; in fact, the shallowness of this soil is partly due to erosion.

This soil is not highly productive because it is so shallow, and, although the deeper areas may produce small yields of cotton and corn in seasons of favorable moisture conditions, the land may be considered marginal, so far as production of cultivated crops is

concerned. Oats are grown rather more extensively than other crops. In some other blackland-prairie counties, a rather large proportion of this kind of land is devoted to oats, and in good seasons from 20 to 40 bushels an acre are produced. In some years, on some of the more favorable areas, where the soil is not exceedingly shallow, cotton yields about one-fourth bale, corn from 15 to 30 bushels, and wheat from 10 to 15 bushels. Small fruits and grapes do moderately well. Terracing to prevent erosion is recommended for this soil. It is probable that it would be better to put much of the land in grass or in sowed sorghum crops rather than in cultivated crops. The soil could be improved by growing sweetclover on it.

Houston clay, gray phase.—The 4- to 8-inch surface soil of Houston clay, gray phase, is gray, very calcareous, and very granular clay which grades into yellow very granular soft calcareous clay containing lumps and particles of soft chalk. At a depth ranging from 12 to 24 inches this material rests on chalk or very chalky marl.

This soil occupies rather steeply sloping areas and, where not protected, is subject to severe washing. It is not extensive. It occurs in the western part of the county, where the chalk formation is exposed. The soil is low in organic matter, in most places is shallow, and is not very productive or well suited to cultivated farm crops. It is used to some extent for corn and cotton, but yields are light. Erosion is severe following these clean-cultivated crops. Oats and small quantities of wheat are grown. Oat yields range from about 15 to 25 bushels an acre and wheat from 6 to 10 bushels. The land requires terracing and the addition of organic matter, in order to make it moderately productive. Sweetclover would be beneficial.

Chalk (Houston material).—This is not a soil but represents an exposure of a geological formation (Austin chalk) of the Upper Cretaceous system. It consists of soft white chalk hardened by exposure to the air to a hard mass resembling limestone. On the surface, fragments of chalk are intermingled with white silty fine earth which in places is 2 or 3 inches thick. This material is of very slight extent.

The surface relief is sloping and ridgelike, and the soil material is washed away before it can develop deep layers. A few shrubs, weeds, and clumps of needlegrass grow in the pockets and cracks where some fine earth has lodged. The land is of no value for crops and should be left for such pasturage as is afforded by the thin vegetal growth. Probably sweetclover could be grown in places where soil has collected to a depth of a few inches, and this would increase the grazing value of the land.

Sumter clay.—Sumter clay, to a depth ranging from 5 to 10 inches, consists of brown or greenish-brown calcareous granular clay which grades into yellow or greenish-yellow clay or partly weathered marl. Below a depth ranging from 2 to 3 feet, the material is calcareous shaly clay or marl of yellow and gray mixed colors. This soil is simply a very shallow and immature phase of Houston clay occurring in places where that soil has been developed from marl and afterward largely removed by erosion. The land is steep, largely denuded of topsoil by erosion, and in many places the yellow clay or marl is exposed at the surface. Both small and large gullies occur in places.

Under present conditions, pasture crops of grasses or sweetclover seem to be the most suitable crops for this soil. Small areas within fields composed mostly of better soils (largely Houston clay) are cultivated. Yields of cotton or corn are very light, and moderate quantities of oats and sorghums are produced, but on the whole the soil requires reclamation before it can be used for most crops. Terracing is required to prevent excessive erosion, and the soil needs organic matter and time to allow it to become of more than marginal productivity.

Irving clay loam, shallow phase.—The shallow phase of Irving clay loam is grayish-brown clay loam to a depth of about 8 inches. It grades into mottled gray and yellow clay which is heavy, dense, and contains many fine, rounded quartz pebbles. This material, at a depth of about 30 inches, grades into yellow marl containing soft concretions of calcium carbonate. The surface soil and subsoil above the marl show no signs of a calcareous condition. The thickness of the soil material overlying the marl ranges from 15 inches in places to as much as 40 inches in others. Apparently this soil comprises a thin layer of water-transported material, which has been largely removed from other areas by erosion, laid down on marl by stream action.

This soil occupies flat ridgelike positions in the highest parts of the blackland prairie, and it is surrounded by sloping and rolling bodies of Houston soils which lie slightly lower than the ridges. On drying the topsoil packs tightly, much as do the Irving and Wilson soils. In places the land is flat, and drainage is slow.

This soil is of slight extent, and most of it is in cultivation, in association with the Houston soils on the high prairies just bordering the drainage divide adjacent to the land descending westward to the Brazos River Valley. Small quantities of cotton and corn are produced, and yields are only moderate. Oats, which produce but low yields, are grown to some extent. Grapes, small fruits, and vegetables are grown in a few small home orchards and gardens.

During the course of the survey, some small areas of Irving fine sandy loam were recognized on narrow ridges in the northern part of the county, associated with the Houston soils. These are not shown separately but are included in the areas of Houston soils.

River wash.—River wash is the term used for sand bars along the inner bends of Brazos River. These bodies of loose sand and fine sand lie only slightly higher than normal stream level and, with slight rises of water in the streams, are inundated and shifted about. Little or no vegetation grows on these strips of sand, and they have no value for crops or even for pasturage.

SOILS AND THEIR RELATIONSHIPS

The soils of Falls County have been developed in a moderately moist climate characterized by rather high temperatures throughout most of the year, and under two kinds of vegetative cover—timber and grass.

There are two general broad groups of well-developed soils and one group comprising soil materials developed from recent alluvium. The upland soils have been developed from two very different kinds

of parent materials—the soils of one group from calcareous unconsolidated beds of chalk, marl, and calcareous clay, and of the other from unconsolidated sandy or clay beds, in which the material is noncalcareous and highly siliceous, in that most of it contains much fine quartz sand.

The two major groups are the dark-colored upland soils and the light-colored upland sandy soils. The soils of the first group occupy the largest areas in the county and comprise sections of the eastern part of the blackland prairie; those of the second group constitute a part of the western border of the east Texas timber country which represents the western edge of the great sandy coastal-plain area.

The dark-colored upland soils have been developed from weathered calcareous materials of the Upper Cretaceous system, and the differences in soil series and soil types within the group are due to slight differences in the proportion of calcium carbonate in the parent materials, in surface relief, and in drainage, and to local variations in soil-development processes. These soils have been developed under a vegetative cover of thickly growing grasses which have given them a dark color and contributed a large quantity of organic matter.

Two subdivisions of these soils, based on structure, are well defined by readily observable features. One comprises the tight soils which occupy the flatter areas. They are low in calcium carbonate and on drying crust densely to a "rawhide" consistence. The soils of the other subdivision are less advanced in development. They contain much calcium carbonate and on drying separate into grains which give, even to the heavy clay soils, a loamy pulverulent character. The better soil materials are gradually worn away by erosion at about the same rate as soil development occurs, and therefore the calcium carbonate of the parent material remains in all the soil layers. This subdivision conforms in character to the Rendzina soils of some European countries.

In flat situations where the processes of soil development go on undisturbed (to a great extent) by erosion for long periods, the rawhide soils are more extensively developed, but the parent materials are somewhat lower in calcium carbonate content beneath these soils than are the materials beneath the Rendzina soils.

In general the regional profile of the deeply developed dark-colored upland soils may be broadly described as a thick dark topsoil underlain by slightly lighter colored but equally heavy or heavier clay subsoil which, at a depth of several feet, grades into yellow or gray calcareous parent material, most of which is heavy clay, though some is grayish-white chalk.

Based on soil characteristics resulting from time, rate, and degree of soil development, and slight differences in character of the parent materials, the prairie soils may naturally be placed in five divisions, each of which represents a step downward from the most mature to the most imperfectly developed soils of the blackland prairies, and the soils in each of these divisions are featured by soil characteristics resultant from the particular mode of development.

The first of these divisions, embracing the soils of most advanced development, may be indicated as the Wilson-Irving division. It includes soils that have been developed on flat surfaces from calcareous clays which as a rule contain a relatively lower amount of

calcium carbonate, at least in most places, than is contained in soils of the other divisions of prairie soils. Owing to flat surface relief and long-continued leaching—a very slow process in these heavy soils—the calcium carbonate has been largely leached from the surface soil and subsoil layers, and concentration of the fine earth particles has largely been made in the layer just beneath the topsoil. This material is so dense and so definitely set apart from the topsoil material as to have a claypan character. The soils of this division occupy a rather large part of the blackland-prairie areas, though less than the soils in other divisions. In Falls County the soils of this division are Wilson fine sandy loam, Wilson clay loam, Wilson clay, Irving fine sandy loam, Irving clay loam, and Falls fine sandy loam. In places, some of these soils give evidence of having been developed under the influence of certain salts which appear in small "salt spots" or "slick spots", where the entire profile from the surface downward has the well-defined structure and appearance of a Solonetz soil. This division of soils is well represented by a profile of Wilson clay loam which was examined one-fourth mile south of Rosebud, and may be described as follows:

1. 0 to 10 inches, dark-gray tight clay loam which is dry, packed densely, and hard. When moist the material is nearly black. It shows no granular structure development. No calcium carbonate is shown by field test with hydrochloric acid. The material rests on the horizon beneath, from which it is sharply separated, with little or no gradational zone.
2. 10 to 26 inches, tight tough air-dry noncalcareous gray clay. The exposed material cracks and separates into small hard irregular clods.
3. 26 to 40 inches, mottled yellow and gray heavy calcareous clay containing a few small concretions of calcium carbonate.
4. 40 to 54 inches, yellow calcareous clay containing gray mottlings. Some calcium carbonate concretions and a few small black round concretions are present.
5. 54 inches +, yellow soft calcareous clay or partly weathered marl containing many white chalky soft lumps of calcium carbonate.

The fine sandy loam and clay of the Wilson series have the same general profile and structural features as the clay loam, and they differ chiefly in the texture of the topsoil.

A laboratory examination of a sample of Wilson clay loam from a slick spot, made by G. S. Fraps of the Agricultural and Mechanical College of Texas, showed a comparatively high concentration of salts, especially chloride, in the upper part of the soil.

The Falls soils are similar to the Wilson soils. They have been developed from marl of low calcium carbonate content, but, owing to slightly better surface drainage and more free aeration and oxidation, the subsoils are somewhat more vividly colored, with red, yellow, and brown spots and streaks appearing throughout the general gray background. Although the surface soil of the Falls soils is somewhat less tightly crusted on drying, the soil material of all horizons becomes hard and packed on drying, and the topsoil and subsoil are so distinctly separated as to produce a claypan. Below a depth ranging from 3 to 5 feet, the dense clay subsoil grades into marl which in places contains some crystals of calcium sulphate.

The Irving soils have the same general physical characteristics as the Wilson soils. They have been developed from calcareous old alluvium on high flat terraces which are underlain to a great depth,

at least in many places, by beds of water-worn rounded gravel. Although they have the tight rawhide structure in their topsoils, together with dense tough clay subsoils, these soils contain very few salt spots and probably have somewhat better underdrainage than the Wilson soils.

The next division of the dark upland soils may be termed the Crockett group, which includes soils that have been developed from about the same kind of parent materials as the Wilson soils, but which, on account of their undulating surface relief and better surface drainage, have not reached the claypan stage of development. These soils are Crockett clay loam, Crockett fine sandy loam, and Riesel fine sandy loam. The soils of this group have dark topsoils which, although not calcareous by field test, do not have the tight dense character of the topsoils of soils in the Wilson group, nor do they have the granular structure of the prairie soils that are rich in calcium carbonate. The topsoils grade into subsoils which, although they are heavy clays, are not so dense and tough as the Wilson soils nor so open and crumbly as the Houston soils. The subsoils are brown, yellow, or mottled red and gray and are not calcareous in the upper part, but at a depth of several feet they grade into marl or slightly calcareous clay. These soils occur mostly at the margins of prairies near timbered sandy soils, and in places oak trees have encroached on them. The Riesel soils appear to have been developed mainly from very old alluvium resting at a depth of several feet on upland marl. Riesel fine sandy loam has a rather dark topsoil grading at a slight depth into heavy mottled red, yellow, and gray clay. Both topsoil and subsoil are free of calcium carbonate but contain much fine rounded quartz gravel. At a depth of several feet the subsoil rests on marl.

The next or third division, which may be called the Houston black clay group, includes Houston black clay, Houston black clay, flat phase, and Bell clay. These are smooth deep black soils which have developed to a great depth, are calcareous throughout, of open structure, and have friable granular topsoil layers. In virgin areas these soils are rich in organic matter, crack deeply in dry seasons, and are featured by numerous shallow pits and elevations—locally called "hog wallows"—which disappear with cultivation. The subsoils are heavy clays ranging from dark gray to brown in color. At a great depth they grade into yellow marl. These are deep highly productive soils, locally known as "black waxy land", owing to their exceedingly sticky character when wet, a condition caused by the large amount of calcium carbonate which has not as yet been leached from the upper layers. The soils break naturally to fine grains on drying and are friable and loamy where cultivated. These soils have been developed from marls and chalk rich in calcium carbonate (largely Taylor marl and Austin chalk) which has not as yet been leached out. In most of the very flat areas, however, the quantity of this substance in the topsoil is noticeably slight. Bell clay, developed from calcareous old alluvium, has not been subjected long enough to the influences of leaching to cause the removal of all the carbonate, but in places the topsoil is low in this constituent. In places Bell clay has better underdrainage than the Houston

soils, owing to the presence of underlying beds of gravel. Houston black clay is one of the most extensive soils of the blackland prairies. The areas are gently or moderately rolling, and, where unprotected, the land is somewhat freely eroded. This soil is much more calcareous than both the flat soils of the group, owing to the fact that it is eroded about as rapidly as soil development takes place. Therefore the calcium carbonate of the parent material remains unleached from the topsoil and other horizons.

Following is a description of a profile of Houston black clay, as observed near Barclay in the southwestern part of the county:

1. 0 to 12 inches, black calcareous clay, the topmost layer of which becomes very granular when dry. The material contains very fine particles of calcium carbonate.
2. 12 to 24 inches, yellowish-brown (very dark gray in places) crumbly calcareous clay.
3. 24 to 60 inches, dark-gray calcareous crumbly clay containing concretions of calcium carbonate.
4. 60 inches+, yellow marl.

Table 4 gives the mechanical analyses of the parent materials lying beneath Wilson clay loam and Houston clay, indicating some of the differences in the character of the parent marls. These analyses were made in the laboratories of the Bureau of Chemistry and Soils.

TABLE 4.—*Mechanical analyses of samples of marl underlying Wilson clay loam and Houston clay in Falls County, Tex.*

Soil type and laboratory no.	Location	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay	Organic matter by H_2O_2
		Inches	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Wilson clay loam, 8564	5 miles west of Lott.	60–72	0.4	0.4	0.3	3.8	16.5	36.1	[1]42.5	0.5
Houston clay, 8565	2 miles west of Rosebud.	60–72	.0	.1	.1	.2	.5	28.4	[2]70.8	.9

[1] Colloid (particles 0.002 to 0.0 mm in diameter) included in clay, 33.2 percent.
[2] Colloid (particles 0.002 to 0.0 mm in diameter) included in clay, 61.6 percent.

Houston clay and Lewisville clay make up a fourth division of dark upland prairie soils and represent another step from maturity, as they are slightly less developed than the soils in the Houston black clay division. These soils are brown, highly calcareous, have thinly developed soil horizons, and grade into highly calcareous clay or marl parent materials which lie near the surface. These soils have thin granular surface layers which develop naturally on drying, but under cultivation they develop to a greater depth. The surface relief is rolling, and the slopes are sufficiently steep to allow severe washing of the topsoil layers; therefore the soils never reach a very advanced stage of development. Houston clay is developed from Taylor marl and Lewisville clay from calcareous old alluvium on high stream terraces underlain at a depth of several feet by beds of rounded gravel. Lewisville clay is associated in places with Bell clay, but it occupies the more sloping and more freely drained areas of the old terraces.

The fifth division includes deeply eroded soils on sloping areas, having thinly developed layers. Most of these soils have been developed from marl and chalk, which lie near the surface in most places. The soils are in the first stages of soil development and, if allowed to continue undisturbed by erosion, would ultimately become the darker, deeper soils of the divisions described. These soils are thin, low in organic matter, and most of them are calcareous. Those of the Irving series are noncalcareous soils which have been incompletely developed from thin old alluvium beds resting on marl. The soils of the fifth division are Houston clay, gray phase; Houston clay, shallow phase; chalk (Houston material); Sumter clay; Irving fine sandy loam; and Irving clay loam, shallow phase. These soils occur in small irregular-shaped areas widely scattered throughout the blackland prairies.

The light-colored upland sandy soils, although of slight extent, are representative of great areas of similar soils extending far to the east through several States. These soils, for the most part, have been developed from unconsolidated noncalcareous sand and clay beds comprising outcropping formations of the Eocene epoch. As they have developed in an area where the rainfall is rather heavy, the very fine earth materials and soluble constituents have been largely leached from the soil layers, although a concentration of the fine-earth particles in the subsoils has caused the subsoils to be heavier than the topsoils in most places. As they have developed beneath a timber growth of oak trees, the organic matter added to the soils has been slight, and the greater part of it has been rapidly oxidized and leached from the soils. The largely siliceous and comparatively coarse fine-earth material, together with the low organic-matter content, has produced the very light color characteristic of these soils. The normal regional soil profile may be broadly described as a loose light-colored sandy layer, low in organic matter, of acid reaction, from 1 to 3 inches thick, grading into a pale-yellow or gray loose sandy layer similar in character to the surface layer, but thicker and containing less organic matter, and this layer, in turn, passing into heavier sandy clay or clay, which differs greatly in physical character and chemical constituents. In general, there are two broad divisions of subsoils in this region—those of permeable and more or less friable or crumbly structure and those having a dense impervious structure of claypan type. Much of the land occupied by the light-colored sandy soils ranges from rolling and steep to gently sloping and, in places, is considerably denuded of topsoil or gullied by erosion.

Although the topsoil layers, owing to leaching and oxidation in the comparatively coarse loose fine earth, have a general similarity in appearance and character, the subsoils, because of differences in aeration and oxidation (in part due to differences in parent materials and in part to topography) differ greatly from place to place and give rise to characteristics on which are based the differentiation of the soils into series.

Norfolk fine sand represents the most advanced stage of development, in that the finer soil particles and most of the soluble salts have

been leached out, leaving a loose bed of highly siliceous yellow or gray fine sand several feet thick. This soil occurs on the higher ridges which are more exposed to the effects of deep leaching of materials.

Susquehanna fine sandy loam and Leaf fine sandy loam are representative of the dense-subsoil group. Percolating rain water has leached downward the finest soil particles and concentrated them in the subsoils. Susquehanna fine sandy loam, with the light-textured topsoil sharply defined from its subsoil, has a red and gray mottled dense clay subsoil. Owing to surface erosion, the topsoil layers are thin and the parent clay materials lie near the surface—in many places the subsoil comprising very little weathered or developed materials. On the other hand, Leaf fine sandy loam has been developed from sandy old alluvium on the high old stream terraces, and it has thicker surface soil and subsoil layers. Because of the smooth surface relief, drainage has been less rapid and erosion of the surface soil less severe. The subsoil of red, yellow, and gray mottled colors is rather dense, but it is sufficiently permeable to allow some oxidation.

Tabor fine sandy loam has a moderately heavy subsoil, though not so dense as the subsoil of Susquehanna fine sandy loam. Underdrainage is sufficiently slow to cause imperfect oxidation of the subsoil, as shown by the gray mottlings throughout the yellow clay.

Milam fine sandy loam has a grayish-brown topsoil and a freely drained friable red sandy clay subsoil which provides good aeration and complete oxidation. The soil has been developed from sandy beds of old alluvium, and, because of the presence of underlying beds of gravel, has good underdrainage. The structure, color, and general characteristics of Milam fine sandy loam are representative of more extensive areas of similar soils of the east Texas timber country, and are fairly representative of the friable, permeable subsoil division of soils of the region as a whole.

The alluvial soils are simply accumulations of assorted soil materials deposited by water in various stages of movement, and they have no developed soil characteristics. These materials, washed from upland soils lying on slopes of the drainage basins of the streams, retain to some extent the color and texture of the original soil materials, and largely on these differences in origin and original characteristics, together with their present color, they are separated into series. These soils are for the most part deep, and they collect and retain water readily. In places drainage is very slow, which is a hindrance to plant growth in early spring but in dry seasons is an advantage in many places. The water table is high, and the soils contain a comparatively large quantity of organic matter and soluble plant nutrients. Though occasionally overflowed by flood waters for short periods, these soils remain fairly free of water most of the year.

Catalpa clay and Catalpa clay loam comprise deep brown fine-earth deposits of calcareous soil materials in the bottoms along creeks which drain chiefly the calcareous dark soils of the uplands.

These soils have fairly good drainage. Trinity clay constitutes black soil materials washed largely from Houston black clay areas. The Trinity soil has a deep black calcareous surface soil rich in organic matter and a black or very dark gray subsoil. This soil also occurs along the creeks and has rather slow natural drainage.

Miller clay, the only representative of the Miller soils in this county, consists of calcareous chocolate-red clay to a depth of several feet. The fine-earth materials have been washed from the "Red Beds" of northwest Texas. The surface relief is flat, and drainage is slow and, in some places, very deficient.

The Pledger soils, of which Pledger clay is the sole representative, have black calcareous clay topsoils resting on red clay subsoils. Pledger clay is made up of deposits of red Miller soils, which have been later covered with flood waters carrying black calcareous prairie soil materials, and these, in turn, have been deposited on the red material. This soil is low, flat, rather poorly drained and occurs at the junction of some of the creek valleys with Brazos River Valley.

The Yahola soils, also in the Brazos River bottoms, are similar to the Miller soils in surface soil features, including color, but they have subsoils which are lighter in texture than the topsoils. The deep subsoils are mainly light-red or grayish-red fine sand or fine sandy loam. These soils are composed of calcareous soil materials washed from the "Red Beds" of northwest Texas, but, owing to inundations and irregular deposition of materials by variable currents, the topsoils are of finer materials than the subsoils.

The Ochlockonee soils are light-colored soils in creek bottoms, composed of materials washed from the light-colored sandy upland soils. They have light grayish-brown surface soils and mottled subsoils. They are fairly well drained in places, although some areas remain wet much of the time.

Table 5 gives the pH values of samples of five soils from Falls County. These determinations were made in the Bureau of Chemistry and Soils, by the hydrogen-electrode method.

TABLE 5.—*pH determinations of five soils from Falls County, Tex.*

Soil type and sample no.	Depth	pH	Soil type and sample no.	Depth	pH
Wilson fine sandy loam:	*Inches*		Riesel fine sandy loam—Con.	*Inches*	
448530	0–10	8.2	4485100	24–34	5.2
448531	10–18	6.7	4485101	34–50+	6.0
448532	18–54	7.1	Crockett fine sandy loam:		
448533	54–72	7.9	4485102	0–12	6.2
Wilson clay:			4485103	12–24	5.6
448549	0–10	7.9	4485104	24–40	5.8
448550	10–42	7.1	4485105	40–70+	5.8
448551	42–60+	7.0	Falls fine sandy loam:		
Riesel fine sandy loam:			4485117	0–10	6.0
448597	0–7	6.7	4485118	10–15	6.1
448598	7–12	5.3	4485119	15–27	7.3
448599	12–24	5.4	4485120	27–60+	7.1

In table 6 are shown the mechanical analyses of samples of the same five soils.

TABLE 6.—*Mechanical analyses of five soils from Falls County, Tex.*

Soil type and sample no.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
Wilson fine sandy loam:	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
448530	0–10	0.1	0.5	0.8	4.8	49.8	29.2	14.7
448531	10–18	.1	.3	.6	5.5	39.3	27.5	26.6
448532	18–54	.1	.2	.3	3.2	31.6	28.7	35.9
448533	54–72	.3	.5	.5	4.8	39.1	28.7	26.0
Wilson clay:								
448549	0–10	.0	.1	.4	2.9	12.2	44.6	39.8
448550	10–42	.1	.2	.6	4.4	15.9	39.9	38.8
448551	42–60+	.0	.1	.7	4.2	15.7	34.3	44.9
Riesel fine sandy loam:								
448597	0– 7	6.3	10.5	11.2	15.5	21.8	17.5	17.2
448598	7–12	5.2	10.1	9.7	11.9	16.6	14.0	32.4
448599	12–24	6.1	10.9	9.9	10.0	11.5	12.7	38.8
4485100	24–34	3.9	11.1	9.9	10.4	12.8	13.0	39.0
4485101	34–50+	4.6	10.9	10.9	10.9	11.4	13.9	37.5
Crockett fine sandy loam:								
4485102	0–12	.2	.3	.6	13.0	52.9	21.8	1.1
4485103	12–24	.0	.1	.2	5.2	25.7	16.3	52.4
4485104	24–40	.0	.1	.1	7.8	46.2	15.4	30.5
4485105	40–72	.0	.0	.1	4.0	55.4	21.5	19.0
Falls fine sandy loam:								
4485117	0–10	.0	.5	1.5	4.7	57.8	22.3	13.1
4485118	10–15	.1	.3	.7	2.2	25.6	22.7	48.3
4485119	15–27	.1	.3	.8	2.7	33.8	25.1	37.1
4485120	27–60+	.1	.3	.6	2.3	42.3	21.4	32.9

SUMMARY

Falls County is in east-central Texas, mainly in the blackland prairie region. The extreme eastern part extends into the western edge of the east Texas timber country. Brazos River crosses the central part and, together with its larger local tributaries, traverses rather wide flat smooth-surfaced valleys.

The climate is moderate and of the humid type. The mean annual precipitation is 33.96 inches, and the average frost-free season extends over a period of 256 days.

The agriculture is centered around the production of cotton, the chief cash crop. In fact, this is one of the leading cotton-producing counties of the State. Most of the farmers produce sufficient feed, largely corn, sorgo, oats, grain sorghum, and Sudan grass for their farm livestock. On most of the strong dark upland soils cotton root rot, a fungous disease, has caused much loss in recent years, and insect pests at times cause losses in cotton yields, especially on the highly productive lands of the alluvial bottoms.

Systematic crop rotations are not generally practiced, but many farmers change their crops on the same land from time to time and realize the advantage of such a procedure. According to results at the Blackland Experiment Station at Temple, Bell County, it has been demonstrated that systematic crop rotations of cotton with nonsusceptible crops, such as the grains, and accompanied by clean cultivation, reduces the root rot disease to a considerable degree.

Commercial fertilizers are used very little in this county, but some are used for special truck crops, more generally on the light-colored upland sandy soils which respond well to soil amendments, such as organic matter, barnyard manure, and commercial fertilizers.

A complete fertilizer, high in nitrogen and phosphoric acid, has proved the most suitable for these soils. The dark-colored upland soils as a rule have not responded profitably to commercial fertilizers.

A very large proportion of the soils is very good agricultural land. The heavier soils are in general well suited to cotton, corn, oats, and several varieties of grain sorghums. The soils comprising the small body of timbered sandy land in the eastern part of the county are only moderately productive, but they are well suited to many different fruits, vegetables, and other truck crops. The sandy soils of the bottom lands and of the high, broader old stream terraces are also well suited to these products. Pecan trees grow to great size and bear well on the well-drained alluvial soils, and many of the native trees were left when the land was cleared of the general forest growth. These have been grafted or budded with improved varieties and are now producing good yields of nuts.

The highly productive dark-colored upland soils predominate, and Houston black clay, Houston clay, and Wilson clay loam occupy a large proportion of the county. About 68 percent of the land is devoted to farm crops, and about 73.7 percent of the crop land is used for cotton and 15.2 percent for corn.

The soils are grouped into the following four divisions on the basis of their economic importance: (1) Dark-colored upland soils, (2) alluvial soils, (3) light-colored sandy upland soils, and (4) miscellaneous soils of low productivity.

On the basis of relationships of soil characteristics, as developed by such factors as parent materials and soil-development processes, the upland soils are naturally of two main divisions: (1) Dark-colored prairie soils and (2) light-colored timberland soils.

On the basis of soil characteristics, as developed in relation to the various local modifying conditions, the dark soils belong to the following categories, listed in order of stage of development, the most advanced being given first and the least developed (most youthful) last:

(1) Wilson-Irving group—dark, tight, "rawhide" claypan soils (Solonetz phase) having thick horizons.

(2) Crockett group—dark, not tight or rawhide and not very friable and granular. Stage of development midway between Rendzina and rawhide.

(3) Houston black clay group—dark thick horizons, calcareous, friable when dry and naturally granular particle separation. Black Rendzinas, also includes Bell clay.

(4) Houston clay group—brown, calcareous, granular soils with thin horizonal development, also includes Lewisville clay. Brown Rendzinas.

(5) Sumter group—thin, shallow very poorly developed soils with steeply sloping and rapidly eroded slopes. These are Sumter clay; Houston clay, shallow phase; Houston clay, gray phase; chalk (Houston material); Irving fine sandy loam, shallow phase; and Irving clay loam, shallow phase. These soils have developed from calcareous clays, marls, and chalk parent materials, much of which

is exposed at the surface or lies at a very slight depth. These soils occur in many small widely scattered bodies.

The light-colored sandy soils developed under a growth of timber comprise two general groups based on subsoil characteristics. The soils of the Susquehanna group, represented by the fine sandy loam, have tight dense subsoils of mottled red and gray colors. To this group belong the Leaf soils, of which the fine sandy loam is the only type mapped. Milam fine sandy loam is representative of a great group of friable permeable sandy or crumbly subsoils in the east Texas timber country. Norfolk fine sand represents the extremely leached mass of loose fine quartz sand and is several feet deep. Tabor fine sandy loam has a moderately dense subsoil and is midway in permeability between the dense- and the friable-subsoil soils of the county.

○

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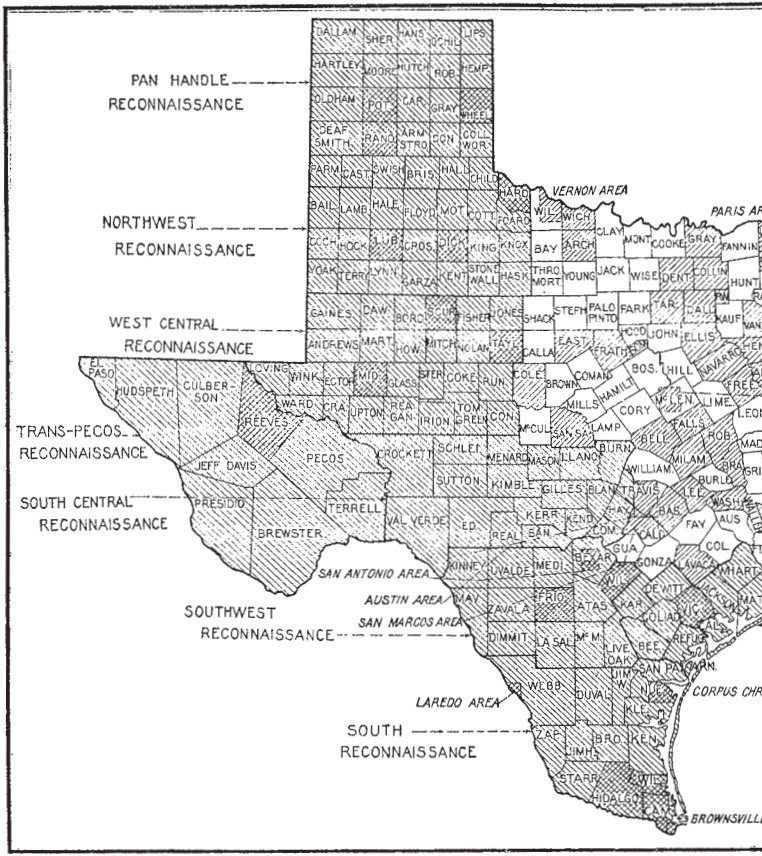

Areas surveyed in Texas, shown by shading. Detailed surveys shown by northe reconnaissance surveys shown by northwest-southeast hatching; crosshatching in both ways.

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CHARLES E. KELLOGG, IN CHARGE SOIL SURVEY

SOIL MAP
FALLS COUNTY
TEXAS

TEXAS AGRICULTURAL EXPERIMENT STATION
A. B. CONNER, DIRECTOR

CONVENTIONAL SIGNS

CULTURE *(Printed in black)*

- City or Village, Roads, Buildings, Wharves, Settles, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R.crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines
- Boundary lines
- Boundary lines
- U.S. township and section lines

RELIEF *(Printed in brown or black)*

- Contours, Depression contours
- Prominent Hills, Mountain Peaks
- Sand Wash, and Sand dunes
- Shore and Low water line, Sandbar

DRAINAGE *(Printed in blue)*

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps, but not all of the foreign signs appear in some maps of earlier dates.

LEGEND

Bell clay — Bl	Houston clay — Hc	Lewisville clay — Lc	Susquehanna fine sandy loam — Sf
Catalpa clay loam — Cc	Hc — Gray phase	Milam fine sandy loam — Mf	Tabor fine sandy loam — Tf
Catalpa clay — C	Hc — Colluvial phase	Miller clay — Mc	Trinity clay — T
Crockett fine sandy loam — Cf	Hc — Shallow phase	Norfolk fine sand — Nf	Wilson fine sandy loam — Wf
Crockett clay loam — Cl	Irving fine sandy loam — If	Ochlockonee fine sandy loam — Of	Wilson clay loam — W
Falls fine sandy loam — Ff	Irving clay loam — Ic	Pledger clay — Pc	Wilson clay — Wc
Houston black clay — H	H — Shallow phase	Riesel fine sandy loam — Rf	Yahola fine sandy loam — Yf
H — Flat phase	Leaf fine sandy loam — Ly	Sumter clay — Sc	Yahola clay — Yc
Gravelly phase	River wash — Rv	Chalk *(Houston material)* — Ch	

William T. Carter, Inspector, District 4,
Soils surveyed by M. W. Beck.

BASE MAP IN PART FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale 1 inch = 1 mile
1 0 1 2 3 4 Miles

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Field Operations
Bureau of Chemistry and Soils
1932